Tanner
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A
Mathematical MANUAL;
CONTAINING
TABLES
OF
LOGARITHMS
FOR
Numbers, *Sines* and *Tangents*:

WITH

The manifold Use thereof, briefly Explained and Applied, in *Arithmetick*, *Geometry*, *Astronomy*, *Geography*, *Surveying*, *Navigation*, *Dyalling*, *Gunnery* and *Gauging*.

By *HENRY PHILLIPPES*.

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To the Right Honourable

Sir William Turner, Kt.

LORD MAYOR

OF THE

City of LONDON.

Right Honourable, and my very good Lord,

BEing bound unto your Lordship in a double Bond, not only as a Private Citizen, but as a Publick Officer under your Cognisance; I thought it my Duty (not only with the general Voice and Plaudit of the City, but in some more publick way) to render to your Lordship most humble and hearty Thanks for your assiduate and indefatigable Industry, which, by the Blessing of Almighty God, hath in so great and unexpected measure not only restored our Ruinous City to its former Condition,

but hath raised it to a far more excellent Glory and Beauty than ever it had, or was like to have, before. As we must all acknowledge, That our Merciful God hath principally and primarily brought this Good out of Evil; so we must also confess, That your Lordship's Honour hath been herein a prudent Joseph *under our Royal Sovereign, and a diligent* Nehemiah *in the repairing of our* Hierusalem: *and, That the Work hath exceedingly prospered in your hands.*

And now, my Lord, though I want Means and Skill to further so good a Work as I would; yet I want not a Mind to do what I can: And therefore I have been (perhaps somewhat too) forward to publish This, and some other Books of this nature. But if your Honour will please to cast a favourable Eye upon it, I doubt not but this little Manual will be of great use to all Mathematical Artificers employed in Building and Beautifying the City: and likewise to all Navigators and Seamen, who are entrusted with the Shipping and Merchandize thereof, wherein the chief Riches, Strength, and Glory, not only

only of the City, but of the whole Kingdom doth consist.

The Advancement whereof, as it is your Lordships present Care, so it shall be my daily and earnest Prayer, That God would continue to bless your Labours herein; and, That you may live to see this Work brought to perfection, to the Honour of your Lordship, the Glory of the City, the Crown and Dignity of our Gracious Sovereign, and the Welfare of the whole Kingdom. So craving your Lordships pardon for my boldness, I rest,

Your Honours

Most humble Servant

And Officer,

HENRY PHILLIPPES.

THE EXPLICATION Of the following *Tables of* LOGARITHMS.

IN this little Book, which I intend only for a Manual or Pocket-Book, I ſhall not trouble you with the manner of Conſtruction of theſe Tables of Logarithms; but ſhall only firſt give you ſome brief general Rules for the better underſtanding of the Tables, and the manner of uſing them; and then give you ſome uſeful and neceſſary Propoſitions in Arithmetick, Geometry, Aſtronomy, Geography, Navigation, Dialling, Gauging, and other Mathematical Arts, which may be of daily uſe, and are moſt eaſily performed by theſe Tables.

CHAP. I.

To find the Logarithm of any Number under 100.

I Begin with the Table of Logarithms for Numbers, though last placed; and the nature of these Logarithm Numbers is such, that let the Number be never so small, or great, yet the Logarithm must have the like number of Places or Figures: Now some make them to 11 Places or Figures, as Mr. *Briggs*; some to eight Places, as Mr. *Gunter* and Mr. *Norwood*; and some to 7 Places, as Mr. *Wingate* and Mr. *Wing*; and accordingly I have fitted these Tables to 7 Places: And in the first Page of the Table you shall find every Logarithm plainly set down to its proper Number, from one to an hundred, after this manner.

The Logarithm of 1 *is* 0,000000.
The Logarithm of 2 *is* 0,301030
The Logarithm of 10 *is* 1,000000.
The Logarithm of 20 *is* 1,301030
And so for all the rest to 100.
The Logarithm whereof is 2,000000.

Now in these Logarithm Numbers you must take notice that each Logarithm is divided

ded into two parts; the one is the Characteriſtical Figure, which is the firſt Figure thereof, and only ſhews of how many Figures or Places the Number ſignified thereby doth conſiſt: the other ſix Figures ſhew more exactly the juſt Number ſignified by the Logarithm.

Thus all Numbers from 1 to 10 have for their Characteriſtical Cypher, thus, 0, 000000; and all Numbers from 10 to 100 have for their Characteriſtick a Figure of One, thus, 1,000000; and all Numbers from 100 to 1000 have for their Characteriſtick a Figure of 2, thus, 2.000000; and all Numbers from 1000 to 10000 a Figure of 3, thus, 3,000000; and all from 10000 to 100000 have for their Characteriſtick a Figure of 4, thus, 4,000000. And ſo if you proceed further, the Characteriſtical Figure is always one leſs than the Places or Figures of the Number.

CHAP. II.

To find the Logarithm of any Number from 100 *to* 1000.

ALL Numbers from 100 to 1000 are ſet down ſucceſſively in the Table following in the Margin of the ſeveral Leaves, and their Logarithms are ſet down in the next

Column just by them, which Column is marked at the top thus [0]; only you must put their Characteristical Figure, which is 2, before them, as I shewed before. Thus,

The Logarithm of 100 *is* 2,000000
The Logarithm of 101 *is* 2,004321
The Logarithm of 102 *is* 2,008600
The Logarithm of 110 *is* 2,041393
The Logarithm of 120 *is* 2,079181

And so for any Number to 1000 successively in this first Column to the end of the Table.

CHAP. III.

To find the Logarithm of any Number from 1000 *to* 10000.

HEre you must observe, That the Table is divided into 10 large Columns, five on the one side of the Book, and five on the other; also each of the Numbers in the Margin are supposed to be increased by 10; and the Figures 0 1 2 3 4 5 6 7 8 9, which are set at the head of each Column, are to be put to the Figures in the Margin, to make them a place more, and so are to be read after this manner.

0 1 2

	0	1	2	4	5.
100	1000	1001	1002	1003	1005

And ſo the Logarithms of thoſe Numbers ſtand in the ſeveral Columns under them; only you muſt prefix the Characteriſtical Figure of 3 before them. Thus,

The Logarithm of 1000 *is* 3,000000
The Logarithm of 1001 *is* 3,000434
The Logarithm of 1002 *is* 3,000868

And ſo read along that Line to 1010, for which you muſt come back again to the Margin of the next Line, and there the Number is 101, to which adding the Cypher or Figures at the top of the Columns, they will make 1010, 1011, 1012, 1013, *&c* to 1020; and their Logarithms are in the next Line, *viz.*

1010	3,004321	1015	3,006466
1011	3,004751	1016	3,006894
1012	3,005180	1017	3,007221
1013	3,005609	1018	3,007748
1014	3,00 038	1019	3,008174

And thus you may find the Logarithm of any Number under 10000 plainly expreſſed in this Table, which after a little uſe will be as familiar, as if each Number were joyned to its Logarithm, as they are in the larger Tables of Mr. *Brigs*. Mr. *Gellibrand, Norwood, &c.*

CHAP. IV.

To find the Logarithm of any Number from 10000 *to* 100000.

As before the Marginal Numbers were divided into 10 parts, so now you must suppose each of these in the several Columns to be divided into 10 parts, and for the better performing of this, the Differences between the Logarithms in each Column are set down in the Margin on the right hand; which Difference being divided into 10 equal parts, will make the proportional Logarithms for the Intermedial Numbers, to which you must prefix the proper Characteristick, which is 4; so have you the Logarithm compleat.

Thus the Log. of 1000 *being* 3,000000
And the Log. of 1001 *being* 3,000434
The difference between them is 434
which being divided into 10 *equal parts, will make the Logarithms of those intermedial Numbers to* 5 *places, thus.*

10000	4,000000	10005	4,000217
10001	4,000043	10006	4,000260
10002	4,000087	10007	4,000304
10003	4,000130	10008	4,000347
10004	4,000174	10009	4,000390

But

But in finding out any of these intermedial Logarithms, you need not write them over all, but multiply the Difference by your intermedial Number.

Thus if you would find the Logarithm of 10005: *The Difference being* 434, *multiply this by* 5, *it makes* 2170; *then cutting off the last Figure, it will be* 217; *which added to the Logarithm of* 10000, *makes* 4, 000217, *as before.*

To help herein, there is a Proportional Table at the end hereof, where each Number to be added to the foregoing Logarithm is ready cast up to your hand. The thing is so plain, that it needs no Example, but what is beforesaid: Only the Table makes the Work more ready for you.

CHAP. V.

A Logarithm being given, to find out the Number belonging thereunto.

THis is but the converse of the former, and therefore you must remember your former Rules, concerning the Characteristical Figure; which, if it be the Figure of 1, then your Number is to be under 100; if it be the Figure 2, then your Number desired must be under 1000; if it be the Figure 3, then your Num-

Number muſt be under 10000; if 4, then the Number is under 100000.

Look therefore in the Tables till you find the Logarithm given, and againſt it in the Margin, according to the former Rules, you ſhall ſee the Number belonging thereunto.

Thus	1,079181 2,079181 3,079181 4,079181	*are the Logarithms of*	12 120 1200 12000

If you cannot find the Logarithm given exactly in the Tables (in moſt Operations) you may take the neareſt Logarithm Number which you can find, either greater or leſs, and take the Number belonging thereunto for your Number deſired.

CHAP. VI.

To find a Logarithm belonging to a Fraction, or a Mixt Number, conſiſting of an whole Number and a Fraction.

DEduct the Logarithm of the Numerator out of the Logarithm of the Denominator, the Remainder is the Logarithm of the Fraction propounded.

Thus

Thus if you would find the Logarithm of $\frac{3}{4}$, *The Logarithm of* 4 *is—Log.* 4. 0,602060
And the Logarithm of 3 *is—Log.* 3. 0,477121

Which subtracted leaves —— *Rest* $\frac{3}{4}$. 0, 124939
for the Logarithm of $\frac{3}{4}$.

But the best way in these Operations is to turn your Fraction or mixt Number into a Decimal Fraction: So the Work will be far more easie, especially in mixed Numbers.

For Example, *Let the Logarithms of these Numbers be required* 12, 12 $\frac{1}{4}$, 12 $\frac{1}{2}$, 12 $\frac{3}{4}$, *you may readily turn these into Decimal Numbers, so they will be* 12, 12 (25, 12 (50, 12 (75. *Now to find the Logarithms for these Numbers, look for them as if they were whole Numbers, only keep the same Characteristick which belongs to the whole Number* 12, *which is* 1. *Thus for*

	The Decimal Fractions are		The Numbers to be taken are		
12		12		12	*log.* 1, 079181
12 $\frac{1}{4}$		12(25		1225	*log.* 1, 088136
12 $\frac{1}{2}$		12(50		1250	*log* 1, 096910
12 $\frac{3}{4}$		12(75		1275	*log.* 1, 105510

But here by the way you may take notice, That though it be easie to reduce these ordinary Fractions of Quarters and Halfs into Decimals, yet in other Fractions it is not so easie, but you must work by this Rule.

Add two or three Figures to your Numerator, and then divide it by your Denominator; so you shall find a Decimal Number exactly equal to your Fraction: Or else, by adding of

more

more Cyphers, and continuing your divifion, you may make it anfwer there unto without any confiderable difference.

Thus	$\frac{1}{4}$	*Are in Deci-mals exactly*	0,25		$\frac{1}{3}$	*Are in decim. very nearly*	0,3333
	$\frac{1}{8}$		0,125		$\frac{1}{6}$		0,1667
	$\frac{1}{16}$		0,625		$\frac{1}{12}$		0,0833
	$\frac{1}{32}$		0,3125		$\frac{1}{24}$		0,0417

And having thus found the Decimal Number anfwering to the Fraction, you may add it to the end of your whole Number, and fo find out the Logarithm thereof by the former Rules.

CHAP. VII.

The Logarithm of a mixt Number being given, to find the Number anfwerable thereunto.

THis Problem, though it be but the converfe of the other, yet it will ferve very well to explain moft that hath been faid before, efpecially that concerning Decimal Fractions, which is very ufeful.

For Example, *Let the Logarithm given be* 1,088136, *and it is required to find the Number correfpondent thereunto.*

In

In the first place observe, that the Characteristick is 1; therefore the Number signified thereby is more than 10, and less than 100, therefore I look for this Logarithm in the first Page of the Table of Logarithms, and find that the nearest Numb. thereunto is 1,079181, which is the Logarithm of 12: So that the natural Number expressed hereby is somewhat more than 12, and yet less than 13 by above one half. And thus all Logarithms that cannot be found exactly expressed in the Tables, are mixed Numbers, and to be expressed by a Decimal Fraction.

Secondly, To know how much it is more than 12 more exactly, go to the following Table, which shews the Log. of all Numbers from 100, to 10000, and there I find for the Log. of 1220 or 12 (20, omitting the Characteristick ,086359, and for the Log. of 1230 or 12 (30, 089905: So that it seems to be much in the middle way between these two Numbers.

Thirdly, Therefore running along the Line against 122, in the first Column on the right-hand-side, which hath the Figure 5 at the top, I find my foresaid Log. 088136 exactly; and therefore I conclude, that the Number expressed thereby is exactly 12 (25.

Lastly, If you could not have found this Logarithm here exactly, then it must fall between this Number and the next in the same Line,

Line, that is, between 1225 and 1226; and by the Difference, and the Table of Proportion, you may ſoon find how much it is more.

As ſuppoſe the Log. had been 088314, this is more than the aforeſaid Log. 088136 by 178, which is the half of the common Difference ſet at the end of this Line, being 355; and ſo the Number deſired is 12(255.

CHAP. VIII.

Of the Uſe of the Table of Proportion.

WHen you have the difference between any two Logarithms, you muſt find out the Proportional Part of that difference either by the Rule of Proportion, or by the Table of Proportion, which is fitted for this purpoſe.

The Rule hath two Caſes,

Firſt, *Knowing the Common difference, to find what you muſt add for any intermediate Number.* This is performed by Multiplication. Thus, let the Common Difference be 355, and you would know what muſt be added for 1, 2, 3, *&c.* work by the Rule of Three, and thus you ſhall find it.

As 10 *to* 355: *So* 1 *to* 35(5.
As 10 *to* 355: *So* 2 *to* 71.
As 10 *to* 355: *So* 3 *to* 106(5.

And ſo for any other of the 10 intermediate Numbers.

The

The Second Caſe is, *Knowing the Common Difference, and likewiſe the Particular Difference of your Number, from the Log. found in the Table.* This is performed by Diviſion, after this manner. Let the Common difference be 355, and your particular Difference 142, or 177 (5.

As 355 *to* 10 : *So* 142 *to* 4.
As 355 *to* 10 : *So* 177 (5 *to* 5.
As 355 *to* 10 : *So* 213 *to* 6.

And ſo for any other of the 10 intermediate Numbers.

But now the Proportional Numbers are ready caſt up in the Tables of Proportion ; ſo that by the Common Difference you may in that Line find all the ten Numbers which you need to uſe in both Caſes, without any farther trouble.

Example. Let the Common Difference be 355, as before ; the Proportional Numbers are thus ſet down,

	1	2	3	4	5	6	7	8	9
355,	35,	71,	106,	142,	177,	213,	248,	284,	319,

which you may uſe according to former directions ; and ſo this ſhort Compendium of 10000 Log. will make 100000, which will be as far as is uſeful in moſt Caſes. If you will make them to ſerve for a Million, you may do it by working the Rule of Three to a place further. Thus,

As

As 100 *to* 355 : *So* 1 *to* 3 (55.
As 100 *to* 355 : *So* 2 *to* 7 (1.
As 100 *to* 355 : *So* 3 *to* 10 (65.

And ſo in the other Caſe,

As 355 *to* 100 : *So* 14 (2, *to* 4.
As 355 *to* 100 : *So* 17 (75, *to* 5.
As 355 *to* 100 : *So* 21 (3, *to* 6.

This alſo may be performed by the Tables of Proportion, counting the ſingle Numbers 1, 2, 3, *&c.* to ſtand firſt for 10, 20, 30 and then cutting off the laſt Figure of the Proportional Numbers, the reſt will ſerve for the ſingle Digits 1, 2, 3, *&c.*

But this being in moſt Caſes needleſs, and alſo the Logarithm Differences being ſcarce exact enough to ſerve to 100 places, I ſhall not inſiſt upon it, but rather adviſe you to uſe a larger Table of Logarithms.

THE

THE EXPLICATION OF THE *Tables of Sines* and *Tangents.*

CHAP. IX.

Any Ark or Angle of a Triangle, containing any number of Degrees and Minutes, being given, to find the Logarithm of the Right Sine or Tangent belonging thereunto.

FIrst, You must understand, That every Circle is divided into four Quadrants, or Quarters; and each Quadrant is divided into 90 Degrees, and each Degree into 60 Minutes, and the Logarithm Sines and Tangents for every one of these Degrees and Minutes are plainly expressed in these Tables, and are thus to be found.

When

When the Number of the Degrees given doth not exceed 45. deg. make ſearch for the ſame at the top of the Pages of the Table entituled *Artificial Sines and Tangents*; and if there be any Minutes joined to the Degrees, you muſt find them out in the firſt Column or Margin towards the left hand, which is marked with the Letter M: And having ſo done, right againſt thoſe Minutes, under the Title *Sign*, at the top of the Table, you ſhall find the Log. of the ſaid Sine and Minutes and under the Title *Tangent* you ſhall have the Log. of the Tangent of the Ark or Angle deſired.

So the Log. of the Sine of an Angle of 23 *d.* 30 *m. is* 9,600700: *And the Log. of the Tangent of the ſame Angle is* 9,638302.

But when the Number of the Deg. required exceeds 45, you muſt look for them at the bottom of the ſaid Table, and you muſt look for the odd Minutes in the firſt Column or Margin towards the right hand, marked likewiſe with the Letter M; and ſo right againſt theſe Minutes, in the Colum above the Title *Sine*, you ſhall find the Log. of the ſaid Sine; and above the Title *Tangent*, you ſhall find the Log. of the ſaid Tangent of the Angle required.

So the Log. Sine of 66 *deg.* 30 *min. is* 9,962398; *and the Log. of the Tangent of the ſaid Angle is* 10,361698. And thus you may find the Logarithm Sine or Tangent of any other Angle.

CHAP.

CHAP. X.

To find the Co-ſine or Co-tangent of any Angle.

THE Co-ſine or Co-tangent of any Angle, is that which others call the Complement of any Angle, or more plainly, the remaining part of that Angle being taken out of 90 Degrees. *Thus the Angle of* 23 *deg.* 30 *min. being taken out of* 90 *deg. the Complement thereof, will be found to be* 66 *deg.*30 *min.* And on the other ſide, *The Angle of* 66 *deg.* 30 *min. being taken out of* 90 *deg. gives for the Complement thereof* 23 *deg.* 30 *min.* So that theſe two Angles are the Complements of each other: And ſo you ſhall find the Complements of any other Angles.

Now theſe Complements being of frequent uſe in Trigonometry, it hath been the care of moſt modern Mathematicians ſo to compoſe their Tables of Sines and Tangents, that theſe Complements ſhould be always joyned or coupled together: And therefore Mr. *Gunter* very fitly calls them Co-ſines and Co-tangents. And this is done by making the Tables of Sines and Tangents (and Secants, where there is any) to run on from 0 *deg. to* 45 *deg.* with their

reſpective

respective Titles at the top of the Table; and then from 45 *deg.* to 90 *deg.* they turn back again in order, with their respective Titles at the bottom of the Table. Thus the Sine and Tangent of every Degree and Minute in one Column, is joyned with its Sine-Complement and Tangent-Complement in the next Column. So that without the trouble of subtracting the Angle from 90 *deg.* you may readily find the Complement thereof, *viz.* either the Arch or Angle in Degrees or Minutes, or the Log. Sine or Tangent by the Arch, according as you have occasion.

Thus the Complement of the Angle 23 *deg.* 30 *min. is* 66 *deg.* 30 *min. the Loga. Sine whereof is* 9,962398, *and the Log. Tangent thereof is* 10,361 98.

So likewise the Complement of the Angle 66 *d.* 30 *min. being* 23 *deg.* 30 *min. the Log. Sine thereof is* 9,600700, *and the Log. Tangent* 9,638302. And so for any other Angle, the Co-sine is still coupled with it in the adjoyning Column.

CHAP.

CHAP. XI.

To find the Secant of any Angle, and the Arithmetical Complements instead thereof.

THE Natural Secants are very neceſſary in Tables, for the expediting of Calculation; and likewiſe the Logarithm Secants (or at leaſt a part of them) are of good uſe, as I ſhall ſhew hereafter. And therefore though in this little Book we had not room to ſet them down, yet I ſhall ſhew you how you may eaſily find them out by the Table of Sines.

Subtract the Logarithm Sine of the Sine Complement of any Angle from the double Radius of the Tables, and that which remains will be the Secant required. *As if I deſire the Secant of* 23 *deg.* 30 *min. I find the Log. Sine of its Complement is* 9,962398, *which ſubtracted from the double of the Radius, that is,* 20,000000, *there remains* 10,037602, *which is the Secant of* 23 *deg.* 30 *min. And ſo alſo,* 10,399300 *is the Secant of* 66 *deg.* 30 *min. it being the remainer of* 9,600700 *taken out of* 20,000000.

Now though theſe Secants be of little uſe, yet the latter part thereof, leaving out the

B Chara-

Characteristick, is of great use, as you shall see by and by. And therefore it will not be amiss to shew you how to find out these Arithmetical Complements, that is, to subtract any Logarithm Number out of the Common Radius, which is 10,000000, after the most ready way.

For Example, *If you were to subtract the foresaid Logarithm Sine* 9,962398 *out of the Radius* 10, 000000: *The common way is first to set down the Radius* ——— ——— ——— 10,000000
Then to set the Log. Sine under it —— 9,962398

Then to subtract the one from the other, so the Remainer is- } 0,037602

But to subtract the Complement of this, or any other Number more readily, you may begin (contrary to the common course) with the first Figure towards the left hand, and write down the Complement or Remainer thereof to 9; and so do also with all the rest of the Figures, saying, 9 wants 0 of 9, and again, 9 wants 0, 6 wants 3, 3 wants 7, 3 wants 6, 9 wants 0; only when you come to the last Figure, take it out of 10; so 8 wants 2 of 10: but count upon 9 for all the former.

9,962398
0,037602

Thus you may readily write out the Arithmetical Complement of any Sine out of the Table, almost as easie as the Sine it self; and therefore in this little Book I have the rather omitted them.

In

In the like manner, if you need the Arithmetical Complement of any Log. Number, you may thus readily ſubtract it. But if you need the Arithmetical Complement of any Tangent, you may take the Co-tangent, which is the exact Arithmetical Complement of the double Radius; ſo that the Tangent and Co-tangent of any Arch make exactly 20,000000. By this alſo you may try the truth of the Tables for the Tangents, and correct them if need be.

CHAP. XII.

To find out the Natural Sine or Tangent of any Angle.

IF you want a Table of Natural Sines and Tangents, and deſire to know the Natural Sine or Tangent of any Angle, look out the Logarithm Sine or Tangent in theſe Tables: Then not much regarding the Characteriſtick thereof, ſee what Number will anſwer to the other part thereof in the Table of Log. Numbers, and that with a little caution will ſhew you the Natural Sine or Tangent deſired.

Example. *I deſire to know the Natural Sine of 23 d. 30 min. Firſt I find the Log. Sine*

thereof in these Tables, and it is 9,600700. *Then omitting the Characteristick* 9, *I seek for* 600700 *in the Table of Log. Numbers, and the nearest Log. Number I can find there is* 600646, *and the Natural Number answering thereunto is* 39,7. *which is the Natural Sine of the said Angle, if you content your self with a Radius of* 10000; *but if you make your Radius* 100000, *then the Sine should be* 39875.

And so by Proportion and the former Rules, if your Tables were large enough, you might find any Sine or Tangent to a Radius of 7 or 8 Figures, as by the Characteristicks of the Log. Sines you may see they are made to a Radius of 11 Figures or Places, the Characteristick of their Radius being 10,000000, which shews their Natural Radius is 10,000, 000, 000, though there be but 8 Figures or Places in the Log. Radius, the rest being omitted, these being taken out of larger Tables, and yet will serve very well in most ordinary Conclusions.

THE

THE SECOND PART:
Shewing the Uſe of theſe
TABLES
OF
LOGARITHMS
In ſeveral Parts of the
MATHEMATICKS.

In ARITHMETICK.

Propoſition 1.

To multiply one Number by another.

LOok the Logarithm of each Number in the Table of Logarithm Numbers, according to the former Rules, and write them down one under the other, and then add the two Log. together by the common Rules of Arithmetick; ſo they will produce a third Logarithm, which third Log being found

out in the Table of Log. you may thereby find out the true Number, which would be produced by the multiplication of the said two Numbers.

Example. 30 *being given to be multiplied by* 25, *would produce* 750. So,

The Log of 30 *being* ———————— 1,477121
Added to the Log. of 25 ———————— 1,397940

Makes a third Log. ———————— 2,875061
which according to the former Rules you will find to be the Log. of 750, *which is the Product of the multiplication.*

Now the Reason of this Operation is grounded upon the Rule of Proportion, which is implicitly required in every Multiplication. So that,

As 1 *is to* 30: *So is* 25 *to* 750.

That is, *So many times as* 1 *is in* 30, *so many times* 25 *is contained in* 750.

Now because a Unit, which is the first Number, doth neither multiply nor divide, therefore the Tables are so framed, that the Logarithm of 1 is 0,000000, only Cyphers, which do neither add nor subtract, and so may be left out, and yet the Log. of the other two Numbers, being added together, fully express the Product which is desired.

The like effect will follow if you use Decimal Fractions in mixt Numbers.

Exam-

Example. *If* 30 *were to be multiplied by* 25.
The Log. of 30 *is* ——— ——— ——— 1,477121
The Log. of 25 *is* ——— ——— ——— 1,397940

Which maketh a third Log. ——— ——— 1,875061
which is the Log. of 75.

But if the Numbers you are to multiply by, be either one or both of them pure Fractions, that is, leſs than one Integer of your Multiplication, you muſt be careful how to characterize your defective Logarithm, and to place your Product accordingly.

You muſt here underſtand, That the Characteriſtick of 1 is 0, 000000; therefore the Characteriſtick of a Fraction that is always leſs than 1, muſt be leſs than 0, 000000: And in the ſame manner as the Characteriſticks of whole Numbers increaſe to be more than 0, 000000, ſo the Characteriſticks of Fractions decreaſe leſs than 0,000000, and are to be marked with a Note of defect thus, —, as you may ſee by the Logarithms of theſe Numbers and Fractions.

Numb.	*Logarithm.*	*Fraction.*	*Logarithm.*
5	0 698970	5.000	0,698970
50	1,698970	0.500	--0 698970
500	2,698970	0.050	--1,698970
5000	3,698970	0.005	--2,698970

Now the beſt way to underſtand your Product is by obſerving theſe Examples, wherein I have explained the Operation, by multiply-

ing these Decimal Fractions in a Natural way, way, filling up all the Places with Cyphers, which makes it very plain.

Example 1. *Multiply* 5 *by* 5.

5	*Log.*	5	0,698970
5	*Log.*	5	0,698970
25	*Log.*	25	1,397940

Example 2. *Multiply* 5 *by* 0, 5; *that is, by five tenth parts, or an half.*

5 0	*Log.*	5 0	0,698970
0,5	*Log.*	0,5	—0,698970
2 50	*Log*	2,5	—1,397940
0 0			
2,5 0			

This is the Log. of 25 as before: But here being one of the Numbers defective, it shews the Figures are to be set a place forwarder, as Fractions; so there remains for the Product 2, 5, or 2, 50 parts; that is, two Integers and an half.

Example 3. *Multiply* 0, 5 *by* 0,5.

0 5	*Log.*	0 5	—0,698970
0 5	*Log.*	0,5	—0,698970
2 5	*Log.*	2 5	—1,397940
0 0			
0,2 5			

This is the Log. of 25 still; but because all the Numbers are defective, it shews this 0,25 must be set two places forward, and made all Fractions:

ctions: So the Product will be 0, 25 hundred parts, that is, a quarter of one Integer.

Here you may farther take notice, that Integers, multiplied by Integers, produce Integers, as in the first Example: and Integers, multiplied by parts, produce Integers and Parts, as in the second Example: But Parts, multiplied by Parts, can only produce Parts, And the smaller the Parts are into which the Integer is divided, the greater will the number of the Product be in shew, but the less in effect, as in the following Examples.

Example 4. 0, 50 *Multiplied by* 0,05.

0,50	*Log.*	0, 50	—0,698970
0,05	*Log.*	0, 05	—1,698970
250	*Log.*	250	—2,397940
000			
000			
0,0250			

Example 5. 0,05 *Multiplied by* 0,05.

0,05	*Log.*	0, 05	—1, 698970
0,05	*Log.*	0, 05	—1, 698970
0,25			3, 397940
000			
000			
0,0025			

Prop. 2.

To divide one Number by another.

First write down the Log. of the Dividend; Then write down the Log. of the Divisor under it, and subtract it from it, and the Remainer will shew the Log of the said Quotient.

Thus if you were to divide 5625 *by* 75, *you will find the Quotient to be* 75, *after this manner:*

The Log. of 5625 *is* ———— ———— 3,750123
The Log. of 75 *to be subtracted is* ——— 1,875061

Rest the Log. of 75 ———— ——— —— 1.875062

Now though here be a Unit difference more in this last Log. than in the Log. of 75, this small difference is not considerable: But if you find a greater difference, it shews there is a Fraction, which may be easily found out if you work by Decimal Fractions.

Example. *Divide* 6321 *by* 84.

The Log. of 6321 *is* ———— —— 3,800786
The Log. 84 *to be subtracted is* ——— 1,924279

Rests Log. ——— ——— ——— —— 1,876507

Now this Log. 1,876507, is much more than the Log. of 75, and yet it is much less than the Log. of 76; therefore here must be a Decimal Fraction found out, according to the Rules of the Seventh Chapter before. Turn

there-

therefore over the Tables till you find 876507, not regarding the Characteristick, and you shall find the Number answering thereunto is 7525. Now because the Characteristick of your Log. is 1, therefore you must take but the two first Figures of this Number for the Quotient, and the two following Figures make a Decimal Fraction, thus, 75 (25, that is, 75 and $\frac{25}{100}$ parts, which is just $\frac{1}{4}$ more.

But here you must take heed, as before in Multiplication, whether your Number by which you divide be a Fraction or not; for that will much alter the Product, though the Log. be the same, only differing in the Characteristick.

As for Example. *If you should divide the foresaid Number 6321 by 0, 84.*

The Log. of 6321 is	3. 800786
The Log. of 0, 84 is	—0, 924279
Which subtracted, there rests	2, 876507
To which adding a Radius, because of the defective Log.	1,000000
The Sum is	3,876507

which is the Logarithm of 7525.

For you must consider, if this Number were divided by 1, *there is* 6321 *Units in it; but being divided by the Fraction* 0, 84, *which is somewhat less than an Unit or Integer, it must needs produce somewhat more,* viz. 7525; *and so many times is that Fraction contained in* 6321.

Prop. 3.

To find the Square Root of any Number.

Half the Logarithm of any Number is the Logarithm of the Square Root thereof.

Exam. *Let the Square Number given be* 5625.
The Log. of 5625 *is* ———— ——3,750123
The half thereof is ———— ——1,875061
which is the Log. of 75, *which is the Root of the said Number.*

Here likewise if you cannot find your Log. exactly in the Tables, you must make it out by a Decimal Fraction, as before.

On the contrary, by doubling the Log. of any Number, you have the Geometrical Square thereof.

Prop. 4.

To find the Cube Root of any Number.

Divide the Log. of the given Number by 3; so you shall have the Log. of the Root required.

Exam. *Let the Cube Number given be* 9261.
The Log. of 9261 *is* ———— ——3,966658
The third part thereof is ————1,322219
which is the Logarithm of 21, *and that is the Cube Root required.*

Likewise multiply the Log. of any Number by 3. and it produceth the Log. of the Cube hereof. Here

Here likewiſe you may make uſe of Decimal Fractions, which in theſe Operations are far more eaſie than others.

Prop. 5.

How to work the Rule of Three, or the Rule of Proportion.

The plain and common way, which is beſt to truſt unto, is after this manner.

As in common Arithmetick, you multiply the ſecond and third Numbers together, and divide their Product by the firſt Number: So here you muſt add the Logarithms of the ſecond and third Numbers together (which is equivalent to the multiplication of them) and then ſubtract the Logarithm of the firſt Number from the Product thereof (which is equivalent to Diviſion) ſo you have the Logarithm of the fourth Number required.

Example.

As 6 *to* 12 : *So* 216 *to* 432.

The manner of the Work muſt be thus.

As 6 *The Log. of* 6, *which is* ——	0,778151
To 12 *the Log, of* 12, *which is* ——	1,079181
So 216 *The Log. of* 216 *which is* ——	2,334454
To 432 *The ſum of theſe* 2 *Log. are* ——	3,413635
From which ſubt. the firſt Log. and there remains	2,634484

which is the Log. of 432, *which is the fourth Term or Number deſired.*

Ano-

Another way to perform this.

This work may be somewhat shortned, if instead of the Log. of the first Number you take the Arithmetical Complement there, as I shewed before *Chap*, 11. and then add the three first Logarithms together, and they produce your desired Logarithm, abating or cancelling the first Figure of the Characteristick.

Example.

As 6 *The Arith. compl. log. of* 6 *is*—9,221848
To 12 *The Logarithm of* 12 *is* — 1,079181
So 216 *The Logarithm of* 216 *is* —— 2,334454

To 432 *The sum of all three*——x2,635483
which, cancelling the first Figure of the Characteristick, makes the Logarithm just as before.

Prop. 6.

The Rule of Three Reverse.

Add the Logarithms of the first and second Numbers together, and then subtract the Log. of the third Number out of them; that which remains will be the Logarithm of the Number required.

Example. *If* 375 *Men build a Wall about a Park in* 72 *days, In how many days may* 133 *Men make the like Wall?*

If 375 *men, Log.* ——— ——— 2,564031
Require 72 *days, Log.* ——— ——— 1,857332

Sum of these two ——— - — 4 431363
What 133 *men? Log. subtr.* ——— 2,233852
203 *days. Rest Log.* ——— 2.307511

Prop. 7.

To find a mean Proportional between two Numbers.

Add the Logarithms of the two Numbers together, and take half the Sum thereof.

Example.

The Numbers given { 9 *Log.* ——— 0 954242
{ 16 *Log.* ——— 1,204120

The Sum thereof ——— ——— — 2,158362
The half thereof ——— ——— — 1,079181
which is the Logarithm of 12, *the Mean Proportional required.*

Prop. 8.

Having three Numbers given, to find a fourth in duplicated Proportion.

Double the Difference of the Logarithms which belong to the two Numbers, having the same Denomination: Then if the first Number

ber be less than the second, add that Difference doubled to the Log. of the other Number: so the Sum thereof will be the Log. of the fourth Number required.

Thus the Superficial Content of a Circle, whose Diameter is 14 Inches, being 154 square Inches; the Content of another Circle whose Diameter is 28 Inches, will be found to be 616.

Diameter 14 Inches, Log.	1,146128
Diameter 28 Inches, Log.	1,447158
Difference	,301030
Difference doubled	,602060
Content given 154 Log.	2,187521
Content required 616 Log.	2,789581

But if the first Number be greater than the second, subtract tue Difference doubled from the Log. of the other Number.

Diameter 28 Log.	1,447158
Diameter 14 Log.	1,146128
Difference	,301030
Difference doubled	,602060
Content given 616	2,789581
Content required 154	2,187521

Prop. 9.

Having three Numbers given, to find a fourth in a Triplicated or Cubical Proportion.

Triple the Difference of the Logarithms which belong to the two Terms which have the same denomination: Then if the first Term be less than the second, add that Sum to the Log. of the other Term; so you shall have the Log. of the fourth Term desired.

Example. *If a Bullet, whose Diameter is* 4 *Inches, weigh* 9 *pounds; another Bullet whose Diameter is* 8 *Inches will weigh* 72 *pounds.*

Diameter 4 *Inches. Log.* ——— ——— 0,602060
Diameter 8 *Inches. Log.* ——— ——— 0,903090

Difference ——— ——— ,301030

Difference Tripled ——— ,903090
Weight given 9 *pounds, Log.* ——— 0,954243

Weight required 72 *pounds, Log.* — — 1,857333

But if the first Term be greater than the second, subtract the Difference tripled from the Log. of the other Term.

Diameter

Diameter 8 *Inches. Log.* 8.	0,90309
Diameter 4 *Inches. Log.* 4.	0,60206
Difference	,30103
Difference Tripled	90309
Weight given 72 *pounds*, *Log.*	1,85733
Weight required 9 *pounds*, *Log.*	0,95424

Prop. 10.

A Sum of Money being forborn for any Number of Years, to find how much it will come to reckoning Interest upon Interest, according to any Rate propounded.

Subtract the Logarithm of 100 from the Logarithm of 100 and the rate added together; then multiply their difference by the number of years propounded, and add the Product thereof to the Logarithm of the principal Sum; so you shall have the Logarithm of the Total Sum which the Principal and Interest doth amount to all together.

Example. *What will* 100 *l. being let out for* 31 *years, increase to after the rate of* 6 per Cent per An. *reckoning Interest upon Interest for the said time?*

First, Subtract 2, 000000, *the Log. of* 100 *from* 2, 0253056, *the Log. of* 106 (*which is the*

the Rate propounded) the Remainer *is* 0,025306, *which being multiplied by* 30 *years, produceth* ,759180; *which added to the Log. of* 100, *makes* 2,759180, *which is the* Log. *of* 574 35: *So that it comes to* 574 l. 7 s.

Prop. 11.

A Sum of Mony being to be paid hereafter, to find what it is worth in ready Mony.

Here the Work is the ſame with that of the former Propoſition; only inſtead of adding, you muſt ſubtract the Product out of the Log. of the Principal: So the Remainer is the Log. of the Sum you ſeek for.

Example. *What is* 100 l. *to be paid* 30 *years hence, worth in ready Mony, after the rate of* 6 l. per Centum?

Here being found the Product, as before, to be 759180, *ſubtract it out of the Logarithm of the Principal, which was* 2,000000; *ſo there remains* 1,240820, *which is the Logarithm of* 17(411, *which ſhews the ſaid* 100 l. *is worth but* 17 l. 8 s. 2 d. 3 q. fere.

Prop.

Prop. 12.

A yearly Rent or Annuity to continue any number of years, to find what it is worth in ready mony, at any Rate of Interest propounded.

Example. *What is* 100 l. per An. *to endure 30 years worth in ready mony at 6* per Cent.

First, *Take the Log. of* 100 *from the Log. of* 106 *and the Rate of interest added together, which is 6* l.

Secondly, *Multiply this Log. found by the number of years which it is to continue, which are* 30 *years.*

Thirdly, *Divide* 100 l. *by the Rate of the Interest, which is 6, and it will produce* 16,6667: *take the Log. hereof and add it to the former Log. which you found, and the Product thereof will yield the Log. of the Arrearages, with that said Sum for that time.*

Fourthly, *Find out the true Number of those Arrearages; and out of them subtract the Proportional part of* 100 *before found, according to the Rate of Interest. So you have the bare Arrearages for that Proportional part.*

Lastly, *Take the Log, of these last Arrearages, and subtract from them the Logarithm found by the Multiplication of years (in the second Rule) so you shall have the Log. of the true value of those Arrearages in ready mony: Then add to them*

them the Log. of the Principal Sum ; so you shall have a Log. the true Number whereof being found out, and reduced into Pounds, Shillings, and Pences is the worth of the Annuity desired.

The Logarithm of 160		2,025306
The Logarithm of 100, *subtr.*		2,000000
Rests		0,025306
Which multiplied by 30		30
Yields		759180
Add the Log. of 16,6667		1,221829
So it makes		1,981009
Which is the Log. of	95,7215 *part.*	
From which subtr.	16,6667	
Rests	79,0548	
The Log. of this Numb. 79,0548		1,897929
Log. found by mult. of years, subtr.		0,759180
Rests		1,138749
Add the Log. of 100 l.		2,000000
So it makes		3,138749

which is the Logarithm of 1376(48, *which is* 1376 l. 9 s. fere.

In

In these Questions it will be convenient to have a Table to reduce these Decimal Fractions into *English* Mony.

A Table of Decimal Fractions for English Mony, the Pound being divided into 10000 parts.

sh.	Decim	*sh.*	Decim.	*d.*	Decim.	*d*	Decim.
19	9500	9	4500	11	0458	3	0125
18	9000	8	4000	10	0417	2	0083
17	8500	7	3500	9	0375	1	0042
16	8000	6	3000	8	0333		*Farthings*
15	7500	5	2500	7	0292	3	0031
14	7000	4	2000	6	0250	2	0041
13	6500	3	1500	5	0208	1	0010
12	6000	2	1000	4	0167		
11	5500	1	0500				
10	5000						

Or else you may count thus, The Pound or 20 *s.* being 10000 parts, every 2 *s.* being a tenth thereof is 1000 parts, and every shilling 0500 parts.

For the pence, The shilling being 0500, the *6 d.* is 0250, which if you cut off the first and last Figure is 25 ; so the two middle Figures will be equal to Farthings, only 1 in 25 over.

Geometrical Propositions.

Prop. 13.

The Side of perfect Geometrical Square being given, to find the Contents.

Double the Log. of the ſide given, ſo you have the Log. of the Contents required.

So the Side of the Square being 10, *the Logarithm thereof is* 1,000000, *which doubled makes* 2,000000, *which is the Log. of* 100, *being the Content thereof.*

Prop. 14.

Having the two joyning Sides, or Length and Breadth of a Long Square, to find the Content thereof.

Add the Logarithms of the two Sides together.

Thus one Side being 20(25 *or a quarter, and the other* 30(75 *parts, or three quarters,*

The Log of 20(25 *is*	1,306425
The Log. of 30(75 *is*	1,487845
The Sum	2,794270

Is the Log. of 622,69 *parts* fere, *which is the Content.*

Prop.

Prop. 15.

The Side of a Geometrical Square being given, to make another Square which shall contain it 2, 3, 4, or any Number of times as much more, or less, or according to any other Proportion.

First double the Log. of the given Side, so you have the Content of the Square. Then increase or diminish the Contents by the Proportion desired. Then find out the Log. of the Contents so increased or diminished, and the half thereof will be the Square Root, which is the Length of the Side desired.

Example. *Let the Side given be* 10, *the Content thereof by* Prop. 13. *is* 100. *Let it be required to make a Square* 3 *times greater, then it must contain* 300. *Now the Logarithm of* 300 *is* 2, 477141, *the half whereof is* 1, 238570, *which is the Log. of* 17, 32 *parts very near.*

Prop. 16.

In a Right-angled Triangle, having the two Sides making the Right Angle, to find the shaping Side.

First, double the Logarithms of the two Sides, so you have the Log. of their Squares severally; which Numbers being found out, must

must be added together by Common Arithmetick, and then find the Log. of their Sum, the half whereof is the Log. of the Side desired.

Example. *Let the two Sides given be 30 and 40.*

Log. of	30,1.477121	*Log. of*	40,1.602060
doubled are	2,954242	*and*	3,204120
Which are Log. of	900	*and*	1600

Which added together make 2500

The Log. of 2500 *is* 3,397940

The half whereof being 1,698970

is the Log. of 50, *which is the Root, or Side of the Square required.*

In like manner you may find the Diagonal or Cross-line, reaching from Corner to Corner of any true Square.

Prop. 17.

In a Rectangular Triangle, having the slope Line, and one of the straight Sides, to find out the other.

Square the Sides, and subtract the lesser Square from the greater Square, and the Remainer is the Square of the remaining Side.

Example. *Let the slope Side be* 50, *and one of the straight Sides* 40, *to find the other Side.*

The Square of 50 is	250[0]
The Square of 40 is	160[0]
Which subtracted, there rests	90[0]
The Log. of 900 is	2,95424[2]
The half whereof is.	1.977121

which is the Log. of 30, and that is the Root or Side required.

The like will be performed by the other Side.

Prop. 18.

Having the two straight Sides of a Rectangular Triangle, to find the Content thereof.

Add the Logarithms of the two Sides together, so you have the Log. of the Content of the whole Square; then take half that Content, and it is the Content of the Triangle.

Thus the Sides of the Triangle being 30 and 40

The Log. of 30 is	1,4771[2]
The Log. of 40 is	1,6020[6]
The Sum is	3,0791[8]

which is the Log. of 1200, the half whereof is 600, which is the Content of the Triangle.

Or else you may multiply one Side by the half of the other: *So 30 multiplied by 20 yields 600, as before.* And this is the reason of the measuring of all Triangles after this manner, by half of one of the Sides, by the other.

Pro-

Prop. 19.

To measure the Content of any Plain Triangle.

The common and best way is to let fall a Perpendicular upon the longest Side, and so multiply that Side and the Perpendicular together, the one by the half of the other.

Let the longest Side of a Triangle be 25, *and the Perpendicular (from the Angle opposed thereunto) be* 12. *Multiply* 25 *by* 6, *either in Simple Numbers or Logarithms; so you have the Content of the Triangle.*

Multiply	25	*Log.*	1.397940
by	6	*Log.*	0,778151
Content	150	*Log.*	2,176091

Prop. 20.

By the three Sides of a Triangle to find the Content.

This is another way, though not so useful as the former. Add the three Sides together, then from the Sum thereof subtract each Side severally, and note the Differences from the said half Sum of the Sides. Then write down the Logarithms of these four Numbers, and add them all together. Last of all take half of

this Sum, and is the Logarithm of the Content desired.

Example. *Let the three Sides of the Triangle be* 15, 20, 25; *their whole Sum is* 60, *the half Sum* 30.

The half Sum		30	Log.	1,47712
The one Side	15	The differences from the half.	5	1,17609
The other	20		10	1,00000
The third	25		5	0,69897
The Sum of all four				4,35218
The half Sum is				2,17609

which is the Logarithm of 150, *being the Content of the said Triangle.*

Prop. 21.

To find the Content of a Circle the common way.

Multiply half the Circumference by half the Diameter.

Example. *The Circumference being* 44, *and the Diameter* 14, *multiply* 22 *by* 7, *the Content will be found* 154.

This way is most exact and ready, provided the Diameter and Circumference be truly known, for which consult the following Propositions.

Prop.

Prop. 22.

he Diameter of a Circle being given to find the Circumference.

Example. *Suppose the Diameter given to be* 14.
s 7, *to* 22 :
o the Diameter 14. *to the Circumference* 44.
Or more exactly, *As* 1,

o 3. 14 6, *whose Log. is*	0,497151
o the Diameter 14. *Log.*	1,146128
o the Circumference	1,643279

hich is the Log. of 43,982, *which is almost* 44, *s the common way.*

The most exact Proportion of the Circum-erence to the Diameter is that of *Van Ceulen*, ho makes it as 1 to 3,14159,26535 89793, 3846,26433,83279,50288 ; but the for-er Rules will serve in most Operations.

Prop. 23.

aving the Diameter of a Circle, to find the Superficial Content.

s 7, *to* 22 :
o quare of Semidiameter, to the Content.

So let the Semidiameter be 7, *the Square ereof is* 49, *and the Content* 154.

 Or

Or else somewhat more Artificially and Exactly,

As 1. to 3, 1416, whose Log. is	0,49715
So Squa. of Semid. 7. Sq. 49) Log.	1,69019
To the Log. of the Content.	2,18734

which is the Log. of 153, 94 parts, which is somewhat more exact than the other.

Prop. 24.

The Circumference of a Circle given, to find the Diameter.

As 22 to 7: So the Circum. to the Diameter.
Or, *As 1, to 0,3183, whose Log. is* —— 0,50283
So the Circumference to the Diameter.

Prop. 25.

By the Circumference to find the Content.

As 4 times 22, which is 88, to 7:
So the Square of the Circumf. to the Content.
Or. *As 1, to 0,0796 whose Log. is* —— 1.90091
So the Square of the Circumf. to the Content.

Prop

Prop. 26.

By the Content of a Circle to find the Diameter.

As 22, *to* 4 *times* 7, *which is* 28:
So the Content, to the Square of the Diameter.
Or, *As* 1, *to* 1, 27324, *whose Log. is* 0, 104910
So the Content to the Square of the Diameter.

Prop. 27.

By the Content to find the Circumference.

As 7, *to* 4 *times* 22, *which is* 88:
So the Content to the Square of the Circumf.
Or, *As* 1, *to* 12, 5664, *whose Log. is* 1,098213
So the Content to the Square of the Circumf.

Prop. 28.

By the Content of a Circle, to find the Side of a Square equal to it.

Extract the Square Root of the Content, by taking half the Logarithm of the Content.

Prop. 29.

By the Diameter of a Circle, to find the Side of the Square equal to the Circle.

As 1, *to* 0,886227, *whose Log. is* —0,947545
So the Diameter to the Side of the Square.

Prop. 30.

By the Diameter of a Circle, to find the Side of the inscribed Square.

As 1, *to* 0,707107, *whose Log. is* —0,849485
So is the Diameter to the inscribed Square.

Prop. 31.

By the Circumference of a Circle, to find the Side of a Square equal to the Circle.

As 1 *to* 0, 282093, *whose Log. is* —0,450392
So the Circumference to the Side of the Square.

Prop. 32.

Having the Circumference of a Circle, to find the Side of the Inscribed Square.

As 1 *to* 0, 225079, *whose Log. is* —0,352334
So the Circumference to the Side, &c.

Prop.

Prop. 33.

As 1 *to* 0,785398, *whose Log is* — 0 985089
So the Proportion of the Square drawn about the Circle, to the Circle included therein.

Prop. 34.

As 1, *to* 1,273240, *whose Log. is* —0,104910
So the Proportion of the Circle drawn about the Square, to the included Square.

Prop. 35.

Having the Axis or Diameter of a Globe, to find the Superficial Content.

Multiply the Diameter by the Circumference.

Or else, *As* 7 *to* 22,
So the Square of the Axis, to the Superficial Content.

7, 22 : : *Sq. Axis* 14 (196) 616.

Or else,
As 1, *to* 3,1416, *whose Log. is* 0.497151
So the Square of the Axis, to the Superficial Content.

1.3,1416 : : *Sq. Axis* 14 (196) 615,75

Prop. 36.

By the Circumference of a Globe, to find the Superficial Content thereof.

As 22, *to* 7
So the Square of the Circumference to the Superficial Content.
Or, *As* 1, *to* 0,3183, *whose Leg. is* — 0,502837
So the Square of the Circumf. to the Content.

Prop. 37.

By the Axis or Diameter of a Globe, to find the Solid Content thereof.

As 6 *times* 7, *which makes* 42, *to* 22
So the Cube of the Diameter to the Solid Content of the Globe.
Or, *As* 1 *to* 0,5236, *whose Log. is* — 0 718999
So is the Cube Diameter, to the Solidity.

Prop. 38.

By the Circumference of a Globe, to find the Solid Content.

As 1 *to* 0,016887, *whose Log. is* — 1,227552
So the Cuble of the Circumf. to the Solid Content.

Prop.

Prop. 39.

Knowing the Solid Content of a Globe, to make a Cube equal to the Globe.

Extract the Cube Root of the Solid Content of the Globe, which is done by taking a third part of the Logarithm of the Solid Content of the Globe.

Prop. 40.

By the Axis of a Globe, to make a Cube equal to the Solid Content thereof.

As 1, *to* 0,80604, *whose Log. is* — 0 906357
So the Axis, to the Cube Root.

Prop. 41.

By the Circumference of a Globe, to make a Cube equal to the Solid Content thereof.

As 1, *to* 0, 256556, *whose Log. is* — 0,409180
So the Circumference, to the Cube Root.

Prop. 42.

By the Axis of a Globe, to make a Square equal to the Superficial Content of the Globe.

As 1, *to* 1 772454, *whose Log. is*—0,248573
So the Axis, to the Square Root.

Prop.

Prop. 43.

By the Circumference of a Globe, to make a Sq. equal to the Superficial Content of the Globe.

As 1, *to* 0,564189, *whose Log. is* – 0.751424
So the Axis, to the Square Root.

Prop. 44.

To measure the Superficial Content of the half of a Circle, or of any Section of a Circle more or less than the half.

Multiply half of the Compass thereof by the Semidiameter of the Circle.

Example. *Suppose a Circle, the Diameter thereof being* 14; *so the Semidiameter is* 7, *and the Compass of the half Circle will be* 22; *and the Content of the said half Circle is required.*

Multiply half the Compass given, which is 11, *by the Semidiameter* 7; *so the Content is found to be* 77.

The like Rule holds for any part of the Circle, more or less than the half, where the Semidiameter is given: But other Sections of Circles cannot well be found, without the Diameter be first found.

Prop.

Prop. 45.

To find the whole Diameter of a Circle, by knowing a part thereof, and the length of the Chord crossing the Diameter in that part.

Let a ſmall part of the Diameter be 4, and let the Chord interſecting it be $12\frac{2}{3}$.

Square one half of the Chord, which is $6\frac{1}{3}$, that is, multiply it by it ſelf, or double the Log. thereof, and it produceth 40; which divide by 4 the part of the Diameter given, and there reſts 10; which added to the ſaid part, ſhews the whole Diameter to be 14.

This Rule holds either for the Section of the Circle, or for the Section of a Globe.

Prop. 46.

To find the Superficial Content of the Segment of a Globe.

Find the Diameter, as in the laſt Problem; then find the Content of the whole Globe thereby, as in *Prop.* 33. and then ſay.

As the whole Diam. 14; *to the Superf. Cont.* 616
So part of the Diam. 4, *to Content thereof* 176.

Prop. 47.

To measure the Content of the Segment of a Circle.

Measure the Chord A B 12 ;. and the Perpendicular D C 4, and multiply the whole of the one by two thirds of the other. This will come very near, as you may see in my *Purchasers Pattern.*

Prop. 48.

To measure an Oval Superficies.

Multiply the Length of the Oval by the Breadth, and divide the Product by 1,27324 whose Log. is 0,104910, and the Arithmetical Complement thereof 9 895090.

Or by way of Proportion,
As 1,27324. *to the Length :*
So the Breadth, to the Content.

Example. *Let the Length of the Oval be* 40, *and the Breadth* 30, *What is the Content ?*

As 1,27324, *Arith Compl.Log.*	9,895090
To the Length 40 *Log.*	1,602060
So the Breadth 30 *Log.*	1,477121
To the Superficial Content	12 974271

which cancelling the Radius, is the Log. of 94248 *parts.*

Prop.

Prop. 49.

To meaſure a Polygon, or a Regular Superficies that hath many equal Sides.

Multiply half the Compaſs by the Length of the Line drawn from the Center ſquare-wiſe, to the midſt of any of the Sides.

Examp. *Let the Polygon have ſix equal Sides, each* 24 *long, the Line, drawn from the Center to any of the Sides ſquarewiſe, will be* 21 fere: *So half the Compaſs will be* 3 *times* 24, *which is* 72; *this multiplied by* 21, *makes* 1512 *for the Content.*

Prop. 50.

To find the Superficial Content of a Cylinder by the Diameter.

As 7 *to* 22, or, *As* 1 *to* 3, 1416:
So the Diameter and Length of the Side multiplied together to the Superficial Content of the out ſide of the Cylinder, beſides the two Baſes,

Example. *Let the Diameter be* 7, *the Side or Length* 12, *which multiplied make* 84

As 1, *to* 3,1416 :: *So* 84 *to* 263, 89.

Or elſe you may work it ſomewhat more readily by Inſtruments.

As 0, 318308 *to the Diameter* 7,
So the Length 12, *to the Content* 264 fere.

And

And by the Tables,

As 0,318308 *Arith. Compl. Log.*	9,497153
To the Diameter 7, *Log.*	0,845098
So the Length 12, *Log.*	1,079181
To the Content 263,89.	11,421432

from which the Radius being subtracted, there remains the Log. of 263,89 *parts, as before, for the Content of the round out-side, not reckoning the two ends, which you may find by the Proportion of the Diameter to the Circle.*

But the best and plainest way is by the Circumference, which being multiplied by the Length, gives the Superficial Content, adding the two ends thereunto.

So the Compass being 22, *multiplied by* 12 *make* 264, *without farther trouble, beside the ends.*

Prop. 51.

To find the Solid Content of a Cylinder.

First, find the Content of the Base, by the Rule of the Circle, or Diameter, or both; then multiply the Content thereof by the Length.

Example. *Let the Cylinders Diameter be* 7, *and the Length* 12, *the Content of the Base will be* 38 ½ fere, viz. 38,4845, *which multiplied by* 12 *makes the Solid Content* 461,814 *parts.*

Prop.

Prop. 52.

To find the Superficial Content of a Cone.

Multiply the whole Side by half the Compaſs of the Baſe, adding the Plane of the Baſe thereunto.

Example. *The Compaſs being* 22, *the Side* 12; 12 *multiplied by* 11, *which is half the Compaſs, yields* 132 *for the Superficial Content of the out ſide, without the Baſe.*

Prop. 53.

To find the Solid Content of a Cone.

Firſt, by the Compaſs find the Plane of the Baſe; then multiply it by a third part of the Height of the Cone.

Example. *The Compaſs being* 22, *and the height* 12, *for the Content.*

Firſt, for the Content of the Baſe,

As 12,56637, *Log.Compl.Arith.*	8,900790
To the Circumference 22 *Log.*	1,342422
So the Circumference 22 *Log.*	1,342422
To the Content of the Baſe	11,585634

which cancelling the Radius, it is the Log. of 38,5153; *which being multiplied by a third part of the Height, which is* 4, *makes* 154,0612 *parts.*

Here

Here you must observe, That the Height of the Cone is not the length of the side line taken on the out-side, from the Base to the sharp Point thereof; but the Line that falls perpendicularly, from the sharp Point, to the Center of the Base, all along through the middle of the Cone, which cannot well be measured, but may be found out by the Semidiameter of the Base, and the side or slope-line on the out-side, by the Rule of the Square, as in *Prop.* 16.

Prop. 54.

To measure a Pyramide.

You may observe here, That a Pyramide differs from a Cone in this respect, That a Cone hath always a round Base and Superficies, like a Sugar loaf; but a Pyramide hath an Angular Base and Superficies, of 4, 6, 8, or any number of Sides. To measure this therefore, you must first find the Superficial Content of the Polygon at the Base, as in *Prop*. 47. then multiply that by a third part of the Height.

And here also the Line of the height cannot be measured on the out-side, but must be found out by the Line drawn from the Center of the Base squarewise, upon the middle of one of the Sides of the Polygon, and then from thence up the middle of one of the Sides, to the Cusp

or

or Point at the top. By these two Lines you may by the Rule of the Square, *Prop.* 16. find the inside Line of the Height, and so find out the Solid Content thereof.

THE

Use of LOGARITHMS

IN

TRIGONOMETRY.

HErein indeed consists their most frequent and most excellent Use: For as Trigonometry is necessary in most parts of the Mathematicks, so it is somwhat difficult and tedious to be performed by Natural Numbers and Arithmetick. And though many Mathematicians have found out some helps therein, by avoiding Division in many Operations; yet none comparable to this of the Logarithms, For, first, these Artificial Sines and Tangents are found as readily as the Natural Sines and Tangents, which must be found out by Tables, it being impossible for any to keep them in memory: And then being found out, they are as easily transcribed. And lastly, the Operation

ration is abundantly more ſpeedily and certainly performed by them; becauſe here is only need moſt times of the Addition of the two found Numbers together, or at moſt but a Subtraction of a third Number from their Product, or inſtead thereof, an Addition of three Numbers together.

Triangles are either Plain or Spherical.

1. *Of Plain or Right-lined Triangles.*

HEre, firſt, take a few general Rules about them.

1. A Plain or Right-line Triangled is a Plain or Superficies contained or comprehended within three Right or ſtraight Lines, joyned together with three Angles or Corners.

2. Theſe Plain Triangle are either Right-angled that is, having one Right Angle, as *Fig.* 1. A B C; or elſe Oblique-Angled, that is, without a Right Angle, as *Fig.* 3. A B C, having all the three Angles either Acute, that is, leſs than *90 deg.* or elſe one of them Obtuſe, that is, more than *90 deg.*

3. In either ſort of theſe Triangles the 3 Angles are always equal to two Right Angles, that is, 180 *deg.*

4. In a Right-angled Triangle, the Right Angle being always *90 deg.* the other two Angles make alſo juſt *90 deg.* in ſuch manner that one is the Complement or Co-ſine of the other;

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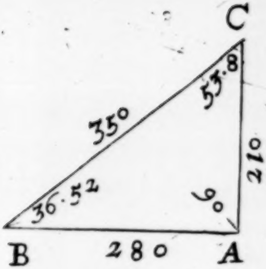

Fig: 1.

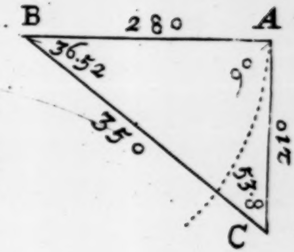

Fig. 2

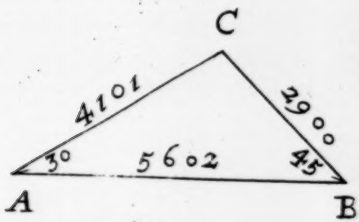

Fig. 3

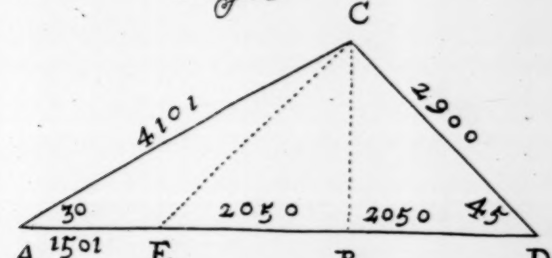

Fig: 4

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other; ſo that one of them being known, the other is alſo known.

5. The Lines about the Triangle, ſome call them Sides, ſome Legs: But in Right-lined Triangles, for better diſtinction, it will be beſt to call B A, the bottom-line, the Baſe; C A, the upright-line, the *Cathetus* or Perpendicular; and B C, the ſlope-line, the Hypotenuſe.

6. Every Triangle hath ſix parts; that is, three Sides and three Angles; and theſe are all proportional one to another: ſo that any three of them being known, the other three may be found out, unleſs it be the three Angles of a Plain Triangle, which only ſhews the Proportion, but you may make the Lines what length you will.

7. The Sines of the Angles are proportional to their oppoſite Sides; and the Sides are proportional to the Sines of their oppoſite Angles.

☞ *Mark this Rule well; for you will find it of great uſe, as you ſhall ſee by theſe following Propoſitions.*

8. If any Angle exceed *90 deg.* ſubtract it out of 180 *d.* and work by the Sine thereof.

Prop.

Prop. 55.

Two Angles and one Side of a Right-angled Triangle being given, to find the other Sides and Angle.

Example. In the first Figure, in the Right-angled Triangle B A C, the Angle at A being known to be a Right Angle, or *90 deg.* and the Angle at B being known to be *36 deg. 52 min. 12 sec.* and the Side B C being known to be 350 Inches, Feet, Yards, Poles, Miles, Leagues, or any other kind of Measure; How may I find hereby the other two Sides, and the other Angle?

First, to find the Angle unknown, which is the Angle at C, you must remember the fourth Rule before-going: And so this being a Right-angled Triangle, the Angle at C is the Complement or Co-sine of the Angle at B. Take therefore the Angle B *36 d 52 m. 12 sec.* out of *90 deg.* and there rests for the Angle at C 53 *d.* 7 *m.* 48 *sec.* which is the Co-sine of the other Angle.

Secondly, to find the Side C A, your best way is to work by its Proportion to the Angle opposed thereunto at B, according to the seventh Rule, for this is a general Rule in all Plain Triangles.

As the Sine of any Angle,
To the Parts of the Side opposed thereunto :
So is the Sine of any other Angle,
To the Parts of the Side opposed thereunto.

And so on the contrary,

As the Parts of any Side, &c.

So that in this Triangle B A C, having the Side B C 350, opposed to the Angle at A 90 *d.* you may thereby find the Side A C, which is opposed to the Angle at B, that Angle being known to be 36 *d.* 52 *m.* 12 *sec.* For,

As the Radius or Sine of the Angle at A 90 *d.*	10,000000
To the opposite Side B C 350	2,544068
So is the Sine of the Angle at B 36 *d.* 52 *m.* 12 *sec.*	9,778151
To the opposite Side A C 210	$\cancel{1}$2,322219

Add the second and third Numbers together, and from their Sum subtract the first; which because it is the Radius, it is done by cancelling the first Figure $\cancel{1}$, so the Remainer is 1,322219, which is the Log. of 210 for the Side desired.

Thirdly, By the same Rule you may find the remaining Side B A, which is yet unknown, by its Proportion to the opposite Angle at C, which was found to be 53 *d.* 7 *m.* 48 *sec.*

As

As the Radius or Sine of 90 d.	10,00000
To the Side opposed B C 350	2,54406
So the Sine of the Angle C 53 *d.* 7 *m.* 48 *sec.*	9.90309

which cancelling the Radius, the Remainer is the Log. of 280, *for the Side* B A. And thus you have found all the six parts of the Triangle.

Prop. 56.

Two Sides and one Angle of a Right-angled Triangle being given, to find the rest of the Parts of the said Triangle.

If the Angle given be opposed unto either of the given Sides, you may work by the Proportion of the opposite Sides and Angles. For,

As the Parts of any known Side,
To the Sine of the Angle opposed thereunto:
So the Parts of any other Side,
To the Sine of the Angle opposed thereunto.

Example. In the Triangle ABC, *Fig.* 1. Let the two given Sides be A B 280, and B C 350, which Side B C is opposed to the Angle A, being know to be 90 *d.*

First, To find the Angle at C opposed to the Side A B.

As the Side B C 350 *Log.*	2,544068
To the opposite Angle A *90 d.*	10,000000
So the Side A B 280	2,447158
Sum	12,447158
To the Sine of the Angle C 53 *d. 7 min. 48 sec.*	9,903090

Add the ſecond and third Numbers, and from the Sum thereof ſubtract the firſt, the Remainer is the Sine of the Angle deſired, which is 53 *d.* 7 *m.* 48 *ſ.*

Secondly, Now this Angle being known, the Angle at B is the Complement thereof, which is 36 *d.* 52 *m.* 12 *ſ.*

Thirdly, For the Side C A, having found the oppoſite Angle at B to be 36 *d.* 52 *m.* 12 *ſ.* you may beſt find it, as before, in the laſt Propoſition.

As the Radius or Sine of the Angle at A *90 d.*	10,000000
To the oppoſite Side B C 350	2,544068
So is the Sine of the Angle at B *36 d. 52 m. 12 ſ.*	9,778151
To the Side A C 210	12 322219

You might have found it alſo by the Side AB, and the Angles B and C; but to work by the Radius is ſomewhat the readier way.

Prop. 57.

In a Right-angled Triangle, the two Sides including the Right Angle being given, to find the rest of the Parts of the Triangle.

Example. In the Triangle B A C, *Fig.* Suppose the Side B A to be 280, and the Side A C to be 210, and the Angle A between them to be a Right Angle 90 *deg.* to find the other parts of this Triangle.

You may make either Side the Radius: But we will suppose the Side B A to be the Radius; so the Side A C is the Tangent of the Angle at B; the Angle at C is the Complement of the Angle at B; and the Side B C is the Secant of the Angle B, or else may be found by the Rule of Opposition.

First to find the Angle B,

As the one Side B A 280 *Log.*	2 447
To the other Side A C 210	2,3222
So is the Radius 90 deg.	10,0000
Sum	12,3222
To the Tang. of 36 d. 52 m 12 sec.	9,875

which is the Angle at B the Complement whereof being 53 *deg.* 7 *min.* 48 *sec.* is the Angle at C.

The

Then for the Side B C,

As the Sine of the Angle B 36 *d.* 52 *min.* 12 *sec.*	9.778151
To its opposite Side A C 210	2,322219
So the Radius, or 90 *deg.*	10,000000
Sum	12,322219
To its opposite Side B C 350	2,544068

Or you may find the Side B C, as it is the Secant to the Angle B.

As the Radius, or 90 *deg.*	10,000000
To the Side B A 280	2,447158
So the Secant of the Angle B 36 *d.* 42 *m.* 12 *sec.*	10,096910
To the Side B C 350	2,544068

If you want the Secant, you may find it by the Arithmetical Complement of the Cosine, as *Chapter* 11.

Or else you may square the two Sides, and then add them together, and the Square Root of the Product will be the sloping Side BC.

The Square of 280 *is*	78400
The Square of 210 *is*	44100
Which added together make	122500
The Logarithm whereof is	3,088136
The half whereof is	2,544068

which is the Log. of 350, *the length of the th* *Side* B C. And thus you have all the Pa of this Triangle.

Prop. 58.

In a Right-angled Triangle, two Sides being g ven, including one of the Acute Angles, find the other Parts of the Triangle.

Example. In the Triangle A B C, *Fig.* Let the Side A B be 280, and the Side B C 35 and the Angle included between them 36 52 *m.* 12 *sec.* to find the other Parts.

First, the Angle at A is a Right Angle, 90 *deg.*

Secondly, The Angle at C is the Compl ment of the Angle at B; therefore it is 53 7 *m.* 48 *sec.*

Thirdly, These being known, the Side C may be found by the Angle B opposed ther unto, as before.

As the Radius 90 deg.	10,0000
To the Side opposed BC 350	2,5442
So the Sine of the Angle B 36 *d.* 52 *m.* 12 *sec.*	9.7781
To the Side AC 210	12,3222

These are most of the Cases of Righ angled Triangles; or to these Rule they may be all reduced.

Of Oblique Triangles.

Prop. 59.

Two Angles of an Oblique Triangle being given, and a Side opposed to either of them, to find the rest of the Parts thereof.

Example. In the Triangle A B C, *Fig.* 3. the Angle at A is 30, the Angle at B is 45, and the Side B C is 2900. To find the rest of the Parts of this Triangle.

First, To find the Angle C, it is the Complement of the other two Angles to 180; for the three Angles always make 180 *d.* as in the third Rule: So that these two Angles, A being 30 *d.* and B 45 *d.* being added together, make 75 *d.* and their Complement to 180 being 105 *deg.* is the Angle at C.

Secondly, The Angles being all thus known, the Sides unknown may be found by their Proportion to their opposite Angles, as before; for the Proportion holds also in these. Thus to find the Side A C,

As the Sine of the Angle A 30 *d.*	9,698970
To the Side opposed to it C B 2900.	3,462398
So the Sine of the Angle B 45 *d.*	9,849485
Sum of second and third	13,311883
To the opposite Side A C 4101	3,612913

In such Cases as these, when you have a Si[ne] or Tangent in the first place, you may work [by] the Arithmetical Complement thereof, and [so] save the Subtraction, as I shewed *Chap.* [...] And so I shall do in the following Operation[s].

Thirdly, Then to find the other Side A[B] by the opposite Angle at C, which is 105.

Here because the Angle exceeds 90 *deg.* yo[u] must work by the Complement to 180, whi[ch] is 75.

As the Sine of A 30 *d. Arit. Comp.*	0,2010[3]
To the Side opposed to it C B 2900.	3,4623[9]
So the Sine of C 105, viz. *Sine* 75.	9,9849[4]
To the Side opposed A B 5602.	✗3,7483[...]

Thus have you all the Parts of the Triang[le].

Prop. 60.

Two Sides and an Angle opposed to one of the[m] being given, to find the other Angles and [the] third Side.

This is but the Converse of the former; fo[r] the Sides and Angles have a mutual proporti[o]n one to the other.

Example. In the Triangle A B C, *Fig.* 3. le[t] the Sides given be AC 4 01, and C B 2900 whereunto the Angle opposed is A 30 *d.* t[o] find the Angle B.

A[s]

As the Side A B 2900 *Comp. Ar.*	6,537602
To the Sine of the opp. Ang. A 30 *d.*	9,698970
So the Side A C 5101	3 612890
To the Sine of the opposite Ang. B	x9,849462

which is 45 *deg.*

Now the Angles A being 30 *d.* and B 45 *d.* which make 75, the Angle C must be 105 *d.* the Complement to 180, and the Side opposed thereto 5602, as was found before.

Prop. 61.

Two Sides of an Oblique Triangle, with the Angle contained between them, being given, to find the other Angles and Side.

In the Triangle A C D, *Fig.* 4. let the Side A C be 4101, and the Side A D 5602, and the Angle between them at A 30 *d.* and it is required to find the other two Angles, and the Side C D.

To resolve this Oblique Triangle, tis a good plain way to part it into two Right-angled Triangles, by letting fall the Perpendicular C B from the Angle C. To perform which,

First For the Right Angle A B C, you have the Hypothenusal A C 4101, and the Angle at A 30 *deg.* Therefore as in *Proposition* 55 by the Rule of opposite Proportion.

As B 90 *deg. to* A C 4101 :
So A 30 *deg. to* C B 2051.
And again,
As B 90 *deg. to* A C 4101 :
So C 60 *deg. to* A B 3551.

Thus you have all the Sides and Angles of the one of these Triangles A C B.

Secondly, For the other Triangle, which is C B D, subtract the Side A B, which was found to be 3551, from the whole Line A D, that is 5602; and there rests 2051 for the Side B D: And thus you have the two straight Sides of the Triangle C B D, *viz.* C B 2051, and B D 2051: And so you may, as in *Prop.* 57. find the Angle D by Tangents.

As BD, *to* BC : : *So Rad. to Tang.* D 45 *d.*

Lastly, For the Side C D, by opposite Proportion,

As B C, *to* D 45 *d* : : *So* B 90 *d. to* C D 2901.

Another way to perform this.

Take the Sum of the two Sides, and the Difference of them, and work thus.	*Side* A D	5602
	Side A C	4101
	Sum	9703
	Diff.	1501

As the Sum 9703, *Log Ar. Com.*	6,013094
To the Diff. of the two Sides 1501	3,176381
So Tang. of ½ *Angles unkn.* 75 *d.*	10,571947
To Tang. of Diff. of Angles 30 *d.*	19,761422

This

	d.	m.
This added to half the Angles unknown, ſhews the greater Angle to	75	0
be 105 *d.* and ſubtracted from it,	30	0
ſhews the leſs Angle to be 45*d.* 0*m.*		
And thus having all the Angles,	105	0
you may find the unknown Side		
C D by its oppoſite Angle at A.	45	0

Prop. 62.

Having the three Sides of an Oblique Triangle, to find the Angles.

In the Triangle A C D, *Fig.* 4. Suppoſe the greater Side A D be 5602

The two leſſer Sides	A C	4101
	C D	2900

The Sum of theſe two	7001.
The Difference of them	1201.

As the greateſt Side	5602 *co. ar.*	6,251657
To Sum of the 2 leſſer	7001	3,845160
So the Differ. of them	1201	3,079543
To a fourth Number	1501	X3,176360

This 1501 is A E a part of the greateſt Side, which being ſubtracted from it, the

Perpendicular will fall in the middle of th
Remainer thereof, and ſo part it into tw
Right angled Triangles.

Thus the greater Side A D *being*	560
The Part to be ſubtracted A E	150
There remains E D	410
The half whereof is D B	205

which is the place where the Perpendicula
C B falls, and is the Baſe of the leſſer Trian-
gle D B C. And this ſubtracted from th
greater Side, leaves 3551 for the Baſe of th
greater Triangle A B C.

Now having theſe two Baſes of theſe two Triangles, and their Hypotenuſas 4101, and 2900 given before, you may by the Rule of Oppoſite Sides to their Angles find all the Angles.

1 In the Triangle A B C,
As A C 4101, *to* B 90 *deg.*
So A B 3551, *to* C 60 *deg.*
The Complement whereof is the Angle A 30 *d.*
2. Then in the Triangle C B D,
As C D 2900, *to* B 90 *deg.*
So B D 2050, *to* C 45 *deg.*
Whoſe Complement is the Angle at D 45 *d.*

Thus in the firſt Triangle A C D, we have found the Angle at A to be 30 *d.* the Angle at D to be 45, and the two Angles at C to be 60 *d.* and 45 *d*, that is in all 105 *d.*

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Fig. 5

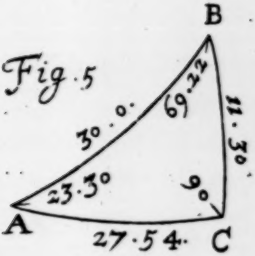


Fig. 6

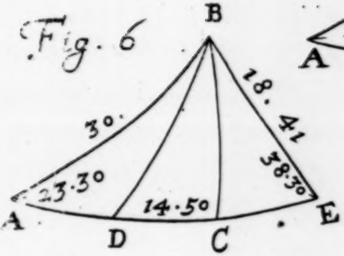


Fig. 7

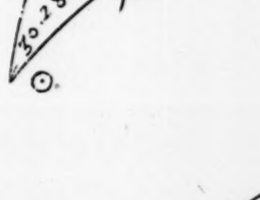
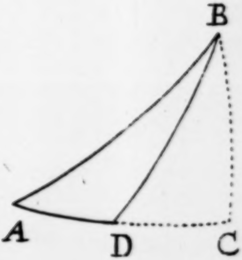


Fig. 8



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OF

SPHERICAL TRIANGLES.

HEre likewiſe you may take a few General Rules for the better underſtanding theſe Triangles.

1. Theſe Spherical Triangles conſiſt of ſix Parts, that is, three Sides and three Angles; any three of which being known, the reſt may be found out.

2. The three Sides of a Spherical Triangle are Parts or Arches of three Great Circles of a Sphere, and as Plain Triangles are meaſured by a Meaſure or Scale of Equal Parts, ſo theſe are to be meaſured by a Scale or Arch of Equal Degrees.

3 A Great Circle is any ſuch Circle as divides the Sphere or Globe into two equal Parts; as the Equinoctial, the Eclip[t]ick, the Meridians, &c.

The Sum of the Sides of a Spherical Triangle are leſs than two Semicircles.

5. The Sum of the three Angles of a Spherical Triangle are greater than two Right Angles, but leſs than ſix.

6. A Spherical Triangle is either Rectangular, or an Oblique-angular Triangle.

7. The

7. The Sines of the Angles are Proportional to the Sines of their opposite Sides; and on the contrary, the Sines of the Sides are proportional to their opposite Angles.

8. In Right-angled Triangles, the Side opposite to the Right Angle is called the Base; the other two are called Sides or Legs.

9. A Perpendicular is part of an Arch of a Great Circle, which, being let fall from any Angle of a Triangle, cuts the opposite Side of the Triangle at Right Angles, and so parts the Oblique Triangle into two Right-angled Triangles. And these two Parts either of the Side or Angle, so divided, must be sometime added together, and sometimes subtracted from each other, according as the Perpendicular falls within or without the Triangle.

Of Right-angled Spherical Triangles.

Prop. 63. Case 1.

The Base and one of the Oblique Angles being known, to find the Side opposed to that Angle.

In the Right-angled Triangle A B C, A represents the Equinoctial Point, A B is an Arch of the Ecliptick, according to the Longitude of the Sun in the beginning of *Taurus*: So that

A B

A B is 30 *d.* B C shews the Diclination of the Sun from the Equinoctial in that Longitude, and A C is an Arch of the Equinoctial Circle, shewing the Right Ascension of the Sun in B.

Now knowing A B to be 30 *d.* and the Angle of the Eclíptick at A to be 23 *d.* 30 *m.* it is required to find the Declination of the Sun, that is, the Side B C opposite to the Angle at A.

As the Radius or Sine of 90 *d.*	10,000000
To the Sine of the Base B C 30 *d.*	9,698970
So Sine of the opp. Ang. A 23 *d.* 30′	9,600700
To Sine of the Side B C 11 *d.* 30′	x9,299670.

which is the Declination of the Sun for that Point B of the Ecliptick. * And if you take this Sine of the Angle of the Ecliptick, 23 *d.* 30 *m.* which is 9,600,700, and write it down in a Paper by it self, and lay it to each Degree and Minute of the Canon of Sines, and so add them together, writing out their Sum in a little Book: it will be no great labor to make an exact Table, shewing the Declination for each Degree and Minute of the Ecliptick.

This also is the way of letting fall a Perpendicular from an unknown Angle; for B C is Perpendicular to A C, from the Angle B.

Prop.

Prop. 64. Case 2.

The Base, and one of the Oblique Angles being known, to find the Side adjacent to that Angle.

As the Radius, to the Cosine of the Angle known: So the Tangent of the Base, to the Tangent of the Side required.

Thus the Base AB being the Longitude of the Sun 30 *d*. and the Angle A being 23 *d* 30 *m*. the Side AC will be found to be 27 *d*. 54 *m*. which is the Suns Right Ascension in that Point.

As the Radius. or 90 deg.	10,000000
To the Cosine of A *Cos.* 23. 30	9.962398
So the Tangent of AB, *Tan.* 30 *d.*	9,761439
To the Tangent of AC 27 *d* 54 *m.*	19 723837

Thus taking this Log. Sine 9 962398, you may make a Table of Right Ascension for every Degree of the Suns Longitude, as before for the Declination.

This also is the way of letting fall a Perpendicular from an Angle known. For AB being Base, AC and BC cut one another at Right Angles in the Point C.

Prop.

Prop. 65. Case 3.

The Base and one of the Oblique Angles being known, to find the other Oblique Angle.

As the Radius, to the Co sine of the Base:
So the Tangent of the Angle given, to the Co-tangent of the Angle required.

Thus the Base A B being 30 *d.* and the Angle A 23 *d.* 30 *m.* the Angle B will be found 69 *d.* 22 *m.* which is the Angle of that Point of the Ecliptick with the Meridian.

And thus you have all the six Parts of the Right angled Triangle A B C. There are other ways to find them: but these are the most ready, having the Radius in the first place.

Prop. 66. Case 4.

The two Sides being given, to find the Base.

As the Radius, to the Co sine of one of the Sides:
So the Co sine of the other Side, to the Co-sine of the Base.

Example. In the Triangle A B C, the Side A C being 27 *d.* 54 *m.* and the Side B C being 11 *d.* 30 *m.* the Base A B will be 30 *deg.*

Prop. 67. Case 5.

The two Sides being given, to find either of the Oblique Angles.

As the Sine of the Side next the Angle required, is to the Radius:
So is the Tangent of the opposite Side, to the Tangent of the Angle required.

Thus in the Triangle ABC, the Side AC being 27 *d.* 54 *m.* and the Side BC being 11 *d.* 30 *m.* the Angle A will be found to be 23 *d.* 30 *m.*

Here work by the Compl. Arith. in the first place.

As the Sine of AC 27. 54 *Co. Ar.*	0,329818
To the Radius	10,000000
So the Tangent of BC 11 *d.* 30′	9,308463
To the Tangent of A 23 *d.* 30 *m.*	9,638281

Prop. 68. Case 6.

One of the Sides, and the Oblique Angle next it being given, to find the Base.

As the Co-sine of the Angle given, is to the Radius:
So the Tangent of the Side given, to the Tangent of the Base.

So

So the Side A C being 27 *d.* 54 *m.* and the Angle at A 23 *d.* 30 *m.* you ſhall find the Baſe to be 30 *d.*

Coſ. A, *Tang* A C : : *Radius*, *Tang.* A B.
23 *d.* 30 27 *d.* 54 90 *d.* 30 *d.* 0

Prop. 69. Caſe 7.

One of the Sides, and the Oblique Angle next it, being known, to find the other Side.

As the Radius, to the Tangent of the Angle given: So the Sine of the Side given, to the Tangent of the Side required.

Let A C be 27 *d.* 54 *m.* the Angle A 23 *d.* 30 *m.* the Side C B will be found 11 *d.* 50 *m.*

Radius, *Tang.* A : : *Sine* A C, *Tang.* C B.
90 23.30 27 54 11 30

Prop. 70. Caſe 8.

One of the Sides, and the Oblique Angle next it, being given, to find the other Oblique Angle.

As the Radius, to the Sine of the Angle given: So the Coſine of the given Side, to the Coſine of the Angle required.

Let A C be 27 *deg.* 54 *min.* and the Angle A 23 *deg.* 30 *min.* the Angle B will be found 69 *deg.* 22 *min.*

Radius

Radius, *Sine* A : : *Cos.* A C, *Cos.* B.
90 23.30 27.54 69.22

Prop. 71. Case 9.

One of the Sides and the Angle opposed to it being known, to find the Base.

Let BC be 11 *d.* 30 *m.* and the Angle A 23 *d.* 30 *m.* you will find the Base AB 30 *d.*
Sine A, *Sine* B C : : *Radius*, *Sine* A C
23.30 11.30 90 27.54

Prop. 72. Case 10.

One of the Sides and the Angle opposed to it being given, to find the other Side.

Let BC be 11 *deg.* 30 *min.* and the Angle A 23 *deg.* 30 *min.* you will find the Side A C to be 27 *deg.* 54 *min.*
Tang A, *Tang.* B C : : *Radius*, *Sin.* A C.
23.30 11.30 90 27.54

Prop. 73. Case 11.

One of the Sides and the Angle opposed to it being given, to find the other Oblique Angle.

Suppose B C 11 *d.* 30 *m.* and the Angle A 23 *d.* 30 *m.* the Angle B will be found 69 *d.* 22 *m.*

Cos.

Cos B C, *Cos.* A : : *Radius Sine* B.
11.30 23.30 90 69.22

Prop. 74. Case 12.

One of the Sides and the Base being known, to find the Oblique Angle next to the same Side.

The Side being A C 27 *d.* 54 *m.* and the Base A B 30 *d.* the Angle A will be 23 *d.* 30 *min.*
Tang. A B, *Radius* : : *Tang.* A C, *Cos.* A.
30.0 90 27.54 23.30

Prop. 75. Case 13.

One of the Sides and the Base being given, to find the Angle opposed to that Side.

The Side A C being 27 *d.* 54 *m.* and the Base A B 30 *d.* the Angle at B opposite to the Side A C will be found 69 *d.* 22 *m.*
Sine A B, *Radius* : : *Sine* A C, *Sine* B.
30.0 90 27.54 69.22

Prop. 76. Case 14.

One of the Sides and the Base being given, to find the other Side.

The Side A C being 27 *d.* 54 *m.* and the Base A B 30 *d.* the Side B C will be found 11 *d.* 30 *m.*

Cos.

Cos. A C. *Radius* : : *Cos.* A B, *Cos.* B C.
27.54 90 30.0 11.30

Prop. 77. Case 15.

The two Oblique Angles being given, to find the Base.

As the Tangent of one of the Angles, is to the Radius:
So is the Cotangent of the other Angle, to the Cosine of the Base.
Tang. A, *Radius* : : *Cotang.* B, *Cos.* A B.
23.30 90 69.22 30.0

Prop. 78. Case 16.

The two Oblique Angles being given, to find either of the Sides.

As the Sine of one of the Angles, to the Cosine of the other Angle:
So is the Radius, to the Cosine of the Side opposed to the Angle, whose Cosine was taken.
Sine A, *Cosine* B : : *Radius*, *Cosine* A C.
Sine B, *Cosine* A : : *Radius*, *Cosine* B C.

Of Oblique Spherical Triangles :

OR,

In all Spherical Triangles.

Prop. 79. Case 17.

Two Angles, and a Side opposite to one of them being given, to find the Side opposed to the other.

Work by opposition of Sides and Angles.

As the Sine of the Angle opposed to the Side known,
To the Sine of the said Side:
So is the Sine of the Angle opposed to the Side required,
To the Sine of the Side required.

Example. Set your Globe to the Latitude of *London*, 51 *deg.* 30 *min.* and turn it about so that the Suns Longitude in the beginning of *Taurus*, or 30 *deg.* may touch the Horizon: So you shall have a Triangle like this, *Fig.* 6. A B D and A B E; wherein the Side AB is the Longitude of the Sun 30 *deg.* the Angle A is the Angle of the Ecliptick 23 *deg.* 30 *min.* the Suns greatest Declination, the Sides

Sides B D and B E will lie in the Horizon, and cut the Equinoctial in the Point D on the East side, and in the Point E on the West Side of the Globe; and so B D or B E represent the Amplitude of the Sun, or his Horizontal Distance from his Equinoctial rising and setting. Lastly, the Angles D and E are the Complements of the Latitude 38 *deg.* 30 *min.*

Now therefore in the Triangle A B E, having the Side A B 30 *deg.* the Angle at A 23 *d.* 30 *m.* and the Angle at E 38 *d.* 30 *m.* the question is, to know the Side, or B E, which is the Amplitude.

Work according to the Rule proposed, you shall find,

As s E, *to*	s A B ::	*So* s A, *to*	s B E.
38.30	30.0	23.30	18.41

which is the Amplitude of the Sun in the Point B, whereunto B D is equal, the one being the Amplitude on the East side, the other on the West; and the Point C is the Point of Right Ascension just between them. And the Difference of Ascension is C E and C D, to be added to or subtracted from the Right Ascension, according as the Sun hath North or South Latitude.

Prop.

Prop. 80. Case 18.

Two Sides, and one Angle opposed to one of those Sides, being given, to find the Angle opposed to the other.

This is but the Converse of the last Proposition, and is performed by the Proportion between the Sines of opposite Sides and Angles.

Example. In the Triangle A B E, *Fig. 6.* the Side A B being 30 *deg.* the Angle E 38 *d.* 30 *m.* and the Side B E 18 *d.* 41 *m.* the Angle A will be found 23 *d.* 30 *m.*

As Sin. A B,	*to Sin.* E : :	*So Sin.* E B,	*to Sin.* A.
30.0	38 30	18 41	23.30

Prop. 81. Case 19.

Two Sides and an Angle included between them being known, to find the other Side.

To resolve this Proposition, the best way is to resolve the Oblique Triangle into two Right angled Triangles, and then work by the former Rules, to find either a Side or an Angle, by any three parts of the Triangle which are known.

In the Triangle Z P ☉, *Fig.* 7. let P represent the Pole of the World, Z the Zenith of *London*, ☉ the Place of the Sun, having 20 *d.* of

of Longitude. Now is this Triangle P Z being 38 *d.* 30 *m.* the Complement of the Latitude of *London*, let P ☉ be 70 *d.* the Complement of the Suns Declination, and the Angle at P 31 *d.* 34 *min.* the Diſtance from the Meridian; the Queſtion is to find the Side Z ☉, which is the Diſtance of the Sun from the Zenith, and is the Complement of the Suns Altitude.

The way to reſolve this, is firſt to let fall a Perpendicular from the Point Z, upon the Side P ☉, which will fall in the Point R. The length of this Perpendicular Z R may be found by the firſt Caſe; and the Side P R by the Second Caſe; which being ſubtracted from P ☉ gives the Side R ☉: ſo the Triangle P Z ☉ is divided into two Right-angled Triangles Z P R and Z ☉ R. Now having the two Sides Z R and R ☉, you may find the Side Z ☉ by the fourth Propoſition, which is the thing deſired.

But to make this ſomewhat ſhorter, and to do it at two Operations, without finding the length of the Perpendicular Z R, work thus. Firſt, *As the Radius or Sine of* Z R P,

To the Coſine of Z P R:

So the Tangent of Z P,

To the Tangent of the Ark P R.

Secondly,

Secondly, *As the Cosine of* P R,
To the Cosine of Z P:
So the Cosine of R ⊙,
To the Cosine of Z ⊙.

So the Height of the Sun at that distance from the Meridian will be about 40 *deg.* having that Declination.

By this Proposition also, having the Complements of the Latitude of any two Places, and their Difference of Longitude, which is the Angle at P, you may find their Distance, which is the Side Z ⊙.

Likewise having the Complements of the Latitudes, or Declinations of any two Stars, and the Differ. of their Longitudes or Right Ascensions for the Angle at P, you may find their Distance, which will be the Side Z ⊙.

But in letting fall this Perpendicular, sometimes it will fall without the Triangle, as here it doth within the Triangle: In that Case the Side of the Triangle must be continued, and so there will be two Right-angled Triangles, the one included within the other.

As for instance, *Fig.* 8. If the Triangle A B D were given, to let fall a Perpendicular from B, the Perpendicular B C falls without the Triangle, upon the Side A D prolonged to C; and so the two Right-angled Triangles found hereby will be A C B and D C B: and so you may by the former Propositions find out the Side B D.

E D

Prop. 82. Case 20.

Two Sides and the Angle included being know
to find either of the other Angles.

As in the Triangle Z P ⊙, *Fig.* 7. knowin
Z P 38 *d.* 30 *m.* and P ⊙ 70 *d* 0 *m.* and th
Angle P 31 *d.* 34 *m.* to find the Angle at ⊙.
First let fall the Perpendicular Z R, or fin
the Arch B R, as in *Case* 19. Then,
As the Sine of ⊙ R, *to the Sine of* P R :
So the Tang. of P, *to the Tang. of* ⊙, 30 *d.* 28′.

Prop. 83. Case 21.

Two Sides being given, and one of the Angles ne
to the Side unknown, to find that Side unknow

As in the Triangle Z P ⊙, *Fig.* 7. having th
Side Z P 38 *d.* 30 *m.* and Z ⊙ 40 *d.* 0 *m.* and th
Angle at P 31 *d.* 34 *m.* to find the Side P ⊙.
First by the Base Z P, and the Angle P, fin
the Side P R being next to the said Angle, b
the second Case, which will be 34 *d.* 7 *m.* 30 *se*
Then,
As the Cos. of P Z, *to the Cos. of* P R :
So the Cos. of Z ⊙, *to the Cos. of* ⊙ R. 35 *d.*
52 *min.* 30 *sec.*
which two parts of the Side added togethe
make the Side P ⊙ 70 *deg.*

If the Perpendicular fall without the Triangle, the two parts should be subtracted from each other.

Prop. 84. Case 22.

Two Sides being given, and one of the Angles next the other Side, to find the Angle included between the two Sides given.

In the Triangle Z P ⊙, knowing Z P 38 *d.* 30 *m.* and Z ⊙ 40 *d.* 0 *m.* and the Angle P 31 *d.* 34 *m.* to find the Angle at Z.

First find the Angle P Z R by the third Case, by the Base Z P and the Oblique Angle P, which will be found to be 64 *d.* 19 *m.*

Then,

As the Tangent of Z ⊙,		
To the Tangent of Z P:		
So the Cosine of P Z R	64 *d*	19 *m.*
To the Cosine of ⊙ Z R	65	44
Which added together make	130	03

which is the whole Angle at Z.

Prop. 85. Case 23.

Two Angles and the Side between being given, to find either of the other Sides.

As in the Triangle Z P ⊙, having Z P 38 *d.* 30 *m.* P 31 *d.* 34 *m.* and Z 130 *d.* 3 *m.* to find the Side Z ⊙.

 First

First find the Angle P Z R by the third Proposition.

As the Radius, to the Cos. of P Z :
So Tang, Z P ⊙, *to Co-tang. of* P Z R *64 d.* 19
This taken out of the whole Ang. at 130 3
There rests the Angle ⊙ Z R 65 44

Then,

As the Cosine of ⊙ Z R, *to the Cosine of* P Z R,
So the Tang. of P Z, *to Tang. of* Z ⊙, 40 *d.* 0

Prop. 86. Case 24.

Two Angles and the Side between them being given, to find the other Angle.

As in the Triangle Z P ⊙ *Fig.* 7. having the Side Z P 38 *deg.* 30 *min.* and the Angle Z P ⊙ 31 *deg.* 34 *min.* and P Z ⊙ 130 *deg.* 3 *min.* to find the Angle at ⊙.

First find the Angle P Z R 64 *d.* 19 *m.* as in the last, which taken out of the whole Angle 130 *d.* 3 *m.* rests 65 *d.* 44 *m.* for the Angle ⊙ Z R.

Then,

As the Sine of P Z R, *to the Sine of* ⊙ Z R:
So the Cos. of Z P ⊙, *to the Cos. of* Z ⊙ P 30 *deg.* 28 *min.*

Prop. 87. Case 25.

Two Angles being given, and one of the Sides adjoyning to the Angle unknown, to find the Side between the two Angles given.

As in the Triangle Z P ⊙, having the two Angles P 31 *d.* 34 *m.* and ⊙ 30 *d.* 28 *m.* and the Side Z P 38 *d.* 30 *m.* to find the Side P ⊙.

First, by the Base P Z and the Angle P you may find the Side P R to be 34 *d.* 7 *m.* 30 *sec.* by the second Proposition of Right-angled Triangles.

1 *As* R, *to Cos.* P:
So Tang. P Z, *to Tang.* P R, 34 *d* 7′ 30″

2. *As the Tang. of* ⊙, *to the Tang. of* P:

So the Sine of P R	34 *d.*	7 *m.*	30 *sec.*
To the Sine of ⊙ R	35	52	30
Which 2 parts of the Side make *The whole Side* P ⊙.	70	00	00

Prop. 88. Case 26.

Two Angles being given, and one of the Sides next the Angle unknown, to find the said Angle.

As in the Triangle Z P ⊙, having the Angle P 31 *d.* 34 *m.* and the Angle ⊙ 30 *d.* 28 *m.* and the Side Z P 38 *d.* 30 *m.* next to the

the Angle of Z which is yet unknown, to find this Angle.

First find the Angle P Z R, by the Base P Z and the Angle P, as in the third Proposition.

As R, *to Cos. Base* P Z:

So Tang. P, *to Cotang.* P Z R, 64 *d.* 19 *m.*

Then find the other part of the Angle ☉ Z R, and add them together thus.

As the Cos. of P, *to the Cos. of* ☉ :	
So the Sine of P Z R	64 *d.* 19 *m.*
To the Sine of ☉ Z R	65 44
Which added make P Z ☉	130 03

Prop. 89. Case 27.

The three Sides being given, to find either of the Angles.

In the Triangle P Z ☉, *Fig.* 7. having P Z the Complement of the Elevation of the Pole 38 *d.* 30 *m.* and P ☉ the Distance of the Sun from the Pole 70 *d.* and Z ☉ the Complement of the Height 40 *d.* to find the Angle at P, which is the Suns Distance from the Meridian, which resolved into Time, is the Hour of the Day.

First, set down the Side opposed to the Angle desired, then the other two Sides, then the Sum of the three Sides, then the half Sum thereof; lastly, the Difference between this half and the first Side. So they will be placed ready for operation, according to this Proportion.

1. *As*

1. *As the Radius, to the Sine of one of the Sides:*
So is the Sine of the other Side, to a fourth Sine.
2. *As that fourth Sine, to the Sine of half the Sum of the Sides:*
So is the Sine of the Difference between the half Sum and the Side opposed to the Angle required, to a seventh Sine.

Now if you add the Radius to this 7th Sine, and then take half the Sum thereof, you shall have the Sine of an Arch, whose Complement being doubled, will be the Angle desired.

☞ *Note,* If you work by the Complements Arithmetical of the two Sines of the Sides comprehending the Angle, and so instead of subtr. them, add the 4 Sums together, the Work is far more ready; as you may see the manner of work both ways in the following Example.

Z ☉	40	0	10, *Radius.*	*Compl. Ari.*
P Z	38	30	9 794149	0,205850
P ☉	70	0	9 972986	0,027014
Sum	148	30	19,767135	*Sines.*
½ *Sum*	74	15	9,783380	9,983381
dif. Z ☉	34	15	9 750358	9,750358
Sub. the 4th *Num.*			19 733738	*Sum of these* 4.
Rest Rad. added			19 966603	19,966603
Half thereof			9,9[illegible]3301	½ 9 983301
Which is the Sine of			15 *deg.* 47	*min.* 13 *sec.*
and doubled makes			31 *deg.* 34	*min.* 26 *sec.*

which is the Angle of the Suns Distance fro the Meridian; which converted into tim shews the Hour of the Day.

By the same manner of work you may fin the Angle at Z, which is the Suns Azimu from the North part of the Meridian, to 130 *deg.* 3 *min.* 11 *sec.* or the Angle at ☉ be 30 *deg.* 28 *min.* 11 *sec.*

Prop. 90. Case 28.

By the three Angles, to find any of the th Sides.

If instead of the greatest Angle next th Side inquired, you take its Complement t 180 *d.* these Angles will be turned into Side and the Sides into Angles; so the Work wi be the same as in the former Proposition.

As in the Triangle Z P ☉, knowing the An gle Z P ☉ to be 31 *d.* 34 *m.* 26 *sec.* P Z ☉ 130 *d.* 3 *m.* 12 *sec.* and Z ☉ P 30 *d.* 28 *min.* 11 *sec.* it were required to find the Side Z ☉ opposit to the Angle Z P ☉. Take 130 *d.* 3 *m.* 11 *sec.* out of 180 *d.* there remains 49 *d.* 56 *m* 49 *sec.*

Then as if you had a Triangle of three known Sides, *viz* one of 31 *d.* 34 *m.* 26 *sec.* another of 30 *d.* 28 *m.* 11 *sec.* and the third of 49 *d.* 59 *m.* 49 *sec.* and you would find the Angle opposite to the first of these Sides: Set the Work as in the last Proposition.

d. m.

	d.	*m.*	*sec.*	
Angle opposite	31	34	26	*Compl. Arith.*
Lesser Angle	30	28	11	0,294920
Compl, greater	49	56	49	0,1 6084
Sum of the 3.	111	59	26	*Sines.*
Half Sum	55	59	43	9 9 8549
Diff. from first	24	25	17	9,516417
				19,945970

The half whereof being 9 972985
is the Cosine of 20 *deg. which being doubled, gives the Side desired to be* 40 *deg.*

And so you may find any of the other Sides.

But when you know either three Sides and one Angle, or three Angles and one Side, you may find the other by their opposite Proportion, as in the seventeenth and eighteenth Propositions.

These are all the usual Cases of Triangles. Many Varieties might be added to each Case, and some Fundament[illegible] [illegible]oms, which might more f[illegible] demonstr[illegible] these Proportions; but the Book [illegible], and intended more for Practice [illegible] I shall leave you for these things [illegible]ners.

 PRO-

PROPOSITIONS IN ASTRONOMY

THough I have partly applied the Examples of the Cases of Spherical Triangles to the Resolution of Astronomical Propositions, yet it will not be amiss to apply them to Astronomy a little more plainly, and to add some common and necessary Propositions.

Prop. 91.

To find the Suns Declination at any time.

1. *As the* Radius, *or Sine of* 90 *deg.*
2. *To the Sine of the* Distance, *or* Longitude of the Sun *from the next Equinoctial-point:*
3. *So is the Sine of the* Suns greatest Declination.
4. *To the Sine of the* Suns Declination *in that Longitude.*

Now to make these Propositions a little the more practical and comprehensive, you may take notice of this Rule of Mr. *Oughtred's*

hov

how to bring any of these four parts of the Operation into the last place; so that if you know any three of the parts, to find out the other thereby.

The Proposition holds thus between them.

As first, to second: So third, to fourth.
As third, to fourth: So first, to second.
As second, to first: So fourth, to third.
As fourth, to third: So second, to first.

Thus, As by the Longitude and greatest Declination, or an Angle of the Ecliptick you may know the present Declination; so by the present Declination, and the greatest Declination, you may know the Longitude.

Prop. 92.

To find the Suns Right Ascension, *or any of these.*

1. *As the Radius,*
2. *To the Sine of the Complement of the* Suns greatest Declination:
3. *So the Tangent of the* Longitude of the Sun *from the next Equinoctial-point,*
4. *To the Tangent of the* Right Ascension of the Sun *from the same Equinoctial-point.*

Prop. 93.

To find the Suns Ascensional Difference, *or any of these.*

1. *As the* Radius,
2. *To the Tangent of the* Poles Height:
3. *So the Tangent of* the Suns Declination,
4. *To the Sine of the* Suns Ascensional Difference.

Which added to, or subtracted from the hour of Six, shews the Suns Rising and Setting.

Prop. 94.

To find the Suns Amplitude, *or any of these.*

1. *As the Sine Complement of the* Poles Height
2. *To the Sine Complement of the* Suns greatest Declination:
3. *So the Sine of the* Suns Longitude *from the next Equinoctial-point*,
4. *To the Sine of the* Suns Amplitude:

Prop.

Prop. 95.

To find the Suns Horary Distance from the Meridian when he is due East or West, *or any of these.*

1. *As the Tangent of the* Poles Height,
2. *Is to the* Radius :
3. *So the Tangent of the* Suns Declination,
4. *To the Sine of the* Suns Horary Distance from the Meridian, being just East or West.

Prop. 96.

To find the Altitude of the Sun being just East or West, *or any of these.*

1. *As the Sine of the* Poles Height,
2. *Is to the* Radius :
3. *So the Sine of the* Suns Declination,
4. *To the Sine of the* Suns Height being just East or West.

Prop. 97.

To find the Suns Altitude at the hour of Six.

1. *As the* Radius.
2. *To the Sine of the* Poles Height :
3. *So the Sine of the* Suns Declination,
4. *To the Sine of the* Suns Height at the hour of Six.

Prop. 98.

To find the Suns Azimuth at the Hour of Six.

1. *As the* Radius,
2. *To the Cosine of the* Poles Height:
3. *So the Tangent of the* Suns Declination,
4. *To the Tangent of the* Suns Azimuth *from the North part of the Meridian at the Hour of Six.*

Prop. 99.

To find the Suns Altitude *at any time of the Day.*

As the Radius,
To the Cotangent of the Poles Height:
So is the Sine of the Suns Distance from the Hour of Six,
To the Tangent of an Arch.
which being subtracted out of the Suns Distance from the Pole, work again thus.
As the Cosine of the Arch found,
To the Cosine of the remaining Arch of the Suns Distance from the Pole:
So is the Sine of the Poles Height,
To the Sine of the Suns Altitude at the Hour required.

Prop.

Prop. 110.

To find the Hour of the Day by the Height of the Sun.

Take the Complement of the *Suns Height*, the Complement of the *Latitude of the Place*, and the Complement of the *Declination of the Sun*, and add theſe three Sides together, as *Caſe* 27. *of Spherical Triangles*; and find the Difference between their half Sum and the Suns Altitude. Then work thus.

1. *As the Radius, to the Coſine of the Latitude*:
   So the Sine of the Suns Diſtance from the Pole, to a fourth Sine.
2. *As that fourth Sine, to the Sine of half the Sum*:
   So the Sine of the Difference, to a ſeventh Sine.

Unto which if you add the Radius, half that Sum will be the Sine of an Arch, whoſe Complement being doubled, will be the Diſtance of the Sun from the Meridian; which converted into Time, will ſhew the Hour of the Day.

The Operation you may ſee in *Caſe* 27. *of Spherical Triangles.*

Prop.

Prop. 101.

To find the Azimuth by the Suns Height.

Take the Complement of the Suns Declination, the Complement of the Latitude, and the Complement of the Suns Height, and add these three Sides together, and find their Difference between their half Sum and the Suns Distance from the Pole, as in *Case* 27. only put the Suns Distance from the Pole first. Then work thus.

1. *As the Radius, to the Cosine of the Latitude:*
   So the Cosine of the Suns Height, to a fourth Sine
2. *As that fourth Sine, to the Sine of half the Sum:*
   So the Sine of the Difference, to a seventh Sine.

Unto which if you add the Radius, half that Sum will be the Sine of an Arch, whose Complement being doubled, is the Azimuth desired.

Prop.

Prop. 102.

Having the Angle of the Azimuth, to find the Hour, or by the Hour to find the Azimuth; or any of these Terms.

1. *As the Sine Complement of the* Suns Declination,
2. *To the Sine of the* Suns Azimuth:
3. *So the Sine Complement of the* Suns Height,
4. *To the Sine of the Suns Horary Distance from the Meridian.*

Prop. 103.

Having the Longitude and Latitude of any Star, to find the Right Ascension and Declination thereof.

1. *As the Radius,*
To the Sine of Stars Longitude from the next Equinoctial Point:
So the Cotangent of the Stars Latitude,
To the Tangent of a fourth Arch.

Compare this fourth Arch with the Arch of Distance between the Poles of the World and the Ecliptick, 23 *deg.* 30 *min.*; and if the Latitude and Longitude of the Star be both of one quality, that is, when the Star hath North Latitude in the six Northern

Signs ♈ ♉ ♊ ♋ ♌ ♍, or South Latitude in the six Southern Signs ♎ ♏ ♐ ♑ ♒ ♓, then shall the Difference between this fourth Arch, and the Distance of the Poles 23 *deg.* 30 *min.* be your fifth Arch.

But if the Longitude and Latitude of the Star be of contrary qualities, that is, one Northern and the other Southern, then add this fourth Arch to the Distance of the Poles 23 *d.* 30 *m.* and the Sum thereof shall be your fifth Arch; with which proceed.

2. *As the Sine of the fourth Arch,*
To the Sine of the fifth Arch:
So the Tangent of the Stars Longitude,
To the Tangent of the Stars Right Ascension from the next Equinoctial-Point.

3. *As the Cosine of the fourth Arch,*
To the Cosine of the fifth Arch:
So the Sine of the Stars Latitude,
To the Sine of the Stars Declination.

Lastly, for proof of your Work,

4. *As the Cosine of the Stars Latitude,*
To the Cosine of the Stars Right Ascension:
So the Cosine of the Declination,
To the Cosine of the Longitude.

And

And thus having found the Right Ascension and Declination of any Star, you may by the former Rules find its Amplitude, its Difference of Ascension, its Distance from the Meridian at any Height observed, and so the Hour of the Night thereby, having first the time of its coming to the South, by subtracting its Right Ascension from the Right Ascension of the Sun.

PRO-

PROPOSITIONS IN GEOGRAPHY

Prop. 104.

To find the Distance of any two Places which differ only in Latitude, being both upon the same Meridian.

1. If the two Places are upon the same side of the Equinoctial: *Subtract the lesser Latitude out of the greater, the Remainer is the Distance required.*

2. If the one Place be on the one side of the Equinoctial, and the other on the other: *Add the two Latitudes together, and the Sum is the Distance required.*

Prop. 105.

To know the Distance of any two Places which differ only in Longitude.

1. If the Places are both of them under the Equinoctial, *Subtract the lesser Longitude out of the greater, the Remainer is the Distance.*

2. If the two Places have the same Latitude, and so under the same Parallel, then,
As the Radius,
To the Cosine of their Latitude:
So the Sine of half their Difference of Longitude,
To the Sine of half their Distance.

Prop. 106.

To find the Distance of two Places which differ both in Longitude and Latitude

This Proposition hath three Cases.

The First Case.

When one Place is under the Equinoctial, and the other toward either of the Poles, Then,
As the Radius,
To the Cosine of their Difference of Longitude:
So the Cosine of their Latitude,
To the Cosine of their Distance.

The Second Case.

When both Places are towards one of the Poles. First,
As the Radius,
To the Cosine of their Difference of Longitude:
So the Cotangent of the lesser Latitude,
To the Tangent of a fourth Arch.

which

which being subtracted out of the Complement of the greater Latitude, the Remainer must be your fifth Arch, Then,

As the Cosine of the fourth Arch,
To the Cosine of the fifth Arch:
So the Sine of the lesser Latitude,
To the Cosine of the Distance required.

The Third Case.

When one Place is toward the North Pole, and the other toward the South Pole. First,

As the Radius,
To the Cosine of their Difference of Longitude:
So the Cotangent of one of the Latitudes,
To the Tangent of a fourth Arch.

which being subtracted out of the other Latitude, having 90 *deg.* added to it, the Remainer is the fifth Arch. Then,

As the Cosine of the fourth Arch,
To the Cosine of the fifth Arch:
So the Sine of the Latitude first taken,
To the Cosine of their Distance.

By these Rules also you may find the Distance of any two Stars, if you know their Longitude and Latitude, or their Right Ascension and Declination, which is of good use in *Astronomy.*

OF

OF NAVIGATION.

N*Avigation* may very well claim place after these Mathematical Arts: for though it be but a Mechanical Art, and commonly practised and professed by rude and unskilful men; yet perfect and ingenious Seamen had need have good skill in all the former Arts: and the more skilful therein the better: Navigation being capable of, and in some sort necessarily requiring good skill in *Arithmetick*, *Geometry*, and *Astronomy*.

Navigation is commonly distinguished into three sorts, Plain Sailing, *Mercator*'s way, and Circular Sailing, or Sailing by the Arch of a Great Circle.

Plain Sailing, or Sailing by the Plain Chart, is the plainest, and the Foundation of all the rest; and near the Equinoctial there is need of no other to be used, because there the Degrees of Longitude, as well as the Degrees of Latitude, are all equal; each Degree being divided into 60 Minutes or Miles, though they are somwhat more than *English* Miles, each Minute or Mile containing about 6000 Feet.

In

In this Art the Seaman hath these helps.

First, He hath his Compass to direct him which way he goes; which is divided first into four Cardinal Points or Quarters, East, West, North, South, and each of these Quarters are divided into eight equal parts, commonly called Rumbs, making in all 32 Points. So that steering by the Compass well made and duly rectified, the Sea-man always knows which way he sails, to a very small matter.

The second help the Sea-man hath in keeping his Account, is a careful Observation (by the Log-line, or some other good way) how many Miles or Leagues he sails every Hour, and so every Watch, and every Day.

The third help is the knowledg and observation of the Latitude, both of the Place from whence he sails, and where he is arrived, or whither he is to sail.

And out of these three things, by the Doctrine of Plain Triangles, he comes to know all that is necessary for the keeping of his Account: So that he may know at any time where he is, how far he hath sailed, and how far he is yet to sail, and which way, or upon what Point of the Compass he is to steer, and all this by these few plain Rules of Right-lined Rectangular Triangles.

Prop. 107.

By the Rumb, and the Diſtance ſailed thereon, to find the Difference of Latitude.

Example. In the firſt Figure of Plain Triangles, Let C A by the Meridian Line, C B the Rumb line ſailed upon, being South-Weſterly or North-Eaſterly from the Meridian 53 *deg.* 8 *min.* and let the Diſtance ſailed thereon be C A 350 Miles: The Queſtion is to find the Difference of Latitude, which is the length of the Line C A in this Triangle A B C.

Here working by the Rule of the Proportion which is between oppoſite Sides and Angles.

As the Angle A, *which is* 90 *d. or Radius*,
To the oppoſite Side C B, *or Diſtance ſailed* 350 *Miles*:
So the Angle B (being the Coſine of the Rumb or Angle C) *Sine* B 36 *d.* 52 *m.*
To the Side oppoſite thereunto, which is C A 210 *Miles.*

which divided by 60, yields 3 *deg.* 30 *min.* for the Difference of Latitude.

Prop. 108.

By the Rumb and Distance to find the Departure from the Meridian; that is, by the same things given as before, to find the Line A B *in the Triangle* A B C, *Fig.* 1.

As the Radius or Angle at A, 90 *deg.*
To the opposite Side C B 350 *Miles*:
So the Sine of the Angle at C, *being the Rumb* 53 *deg.* 8 *min.*
To the Line A B 280 *Miles.*
which divided by 60, yields 4 *deg.* 40 *min.* for the Difference of Longitude.

By these two Propositions you may keep an Account of your way, how much you sail East or West, North or South.

Prop. 109.

By the Rumb and the Difference of Latitude, to find the Distance sailed.

In the first Figure, let C be the Angle of the Rumb, C A the Difference of Latitude, to know the Distance sailed thereby.
As the Angle B *which is the Cosine of the Rumb,*
To the Difference of Latitude C A:
So the Angle A 90 *deg. or Radius,*
To the Distance sailed C B.

By

By this Propoſition you may help your ſelf, when your Latitude by Obſervation doth not agree with your Dead Reckoning kept by the two former Propoſitions: For if your Latitude be found to be more or leſs than you reckon upon, you may be ſure you have either made more or leſs way upon your Rumb, or elſe that you have not ſteered exactly upon that Rumb: But the other is moſt likely, eſpecially if you ſail within four or five Points of the Meridian. And ſo, according to this Rule, you muſt make your way ſailed agree with your Obſerved Latitude, and ſo correct your Account or Dead Reckoning.

Prop. 110.

By the Difference of Latitude, and Difference of Longitude of two Places, to find the Rumb leading from one Place to the other.

In the firſt Figure, Let the two Places be C and B, let C A be the Difference of Latitude 210 Miles or Minutes, and A B the Difference of Longitude 280 Miles or Minutes; to find the Rumb or Angle at A.

As the Difference of Latitude C A 210,
To the Difference of Longitude A B 280:
So the Radius,
To the Tangent of the Rumb 53. 8.
which is four Rumbs 3 quarters *fere* from the

Meridian South-westerly; that is, almost S. W. by W.

These are the most common and necessary Rules in Plain Sailing, which is only to be used in small Distances, near the Equinoctial, where the Degrees of Longitude are just equal to the Degrees of Latitude, *viz.* each of them 60 Miles or Minutes. But if you are far distant from the Equinoctial, there though these Rules hold good to find the Difference of Latitude and Distance by the Rumb, yet they fail much in the Longitude; and therefore to find the Difference of Longitude, you must use the following Proposition.

Prop. III.

To know how many Miles or Minutes of the Equinoctial make a Degree of Longitude in any Latitude.

As the Radius, or whole Sine of 90 deg.
To 60 Miles:
So the Cosine of the Latitude,
To the Miles contained in one Degree of Longitude, in that Latitude.

Thus in the Latitude of 60 *deg.* 30 Miles make a Degree.

As Sine 90 deg. to 60 miles:
10000
So Cos. 60 deg. to 30 miles.
5000

These

These things may be done very well by the Table of Natural Sines in the *Sea-mans Kalendar.*

Thus if in the former Example your Departure from the Meridian was 280 Miles; this divided by *60*, and so reduced into Degrees and Minutes of Longitude, under the Equinoctial it yields 4 *deg.*40 *min.* But if this 280 Miles of East or West, or Departure from the Meridian, should be in the Latitude of *60 d.* where 30 Miles make a Degree of Longitude, divide this 280 Miles by 30, so it yields *9 d.* $\frac{10}{30}$, or $\frac{1}{3}$, which is 20 *min.* for the Difference of Longitude in that Latitude. But this being so necessary a Conclusion in Navigation, take it in another Form and Example, which will fully explain it, and yield a more ready way for your Calculation of the Longitude in any Latitude.

Prop. 112.

By the Miles of Easting or Westing (that is, your Departure from the Meridian) to find the Degrees and Minutes of Longitude answerable thereunto in any Latitude.

As the Cosine of the Latitude (in a parallel Course, or of the middle Latitude in any other Course which hath Difference of Latitude)

Is to the Radius, or Sine of 90 deg.
So the Miles of Departure from the Meridian,
To the Minutes of Longitude in that Latitude.

Example. In the Triangle C B A, *Fig.* Let C be the one Place, B the other: Suppose C to be in the Latitude of 50 *d* B in the Latitude of 46 *d*. 30 *m*. In sailing between these two Places upon the Rumb-line C B, I find the Departure from the Meridian of C to be 280 Miles. The Question is to know the Difference of Longitude between these two Places.

To resolve this, you must neither reckon these Miles of Departure, 280, in the Latitude of C, that is, 50 *d.* nor in the Latitude of B, that is, 46 *d.* 30 *m.* but in the middle Latitude between the two Places, that is, in the Latitude of 48 *d.* 15 *m.* and work thus.

As Cos. 48 *d.* 15. *Compl. Arith.*	0,17660
To the Radius	10,00000
So 280 *Miles of Departure*	2,44715
To 420 ½ *min. of Longitude*	X2,62376

This yields 420 *m.* ½ of Longitude, which divided by 60, yields 7 *d.* 0 *m.* ½ for the Difference of Longitude of these two Places.

And thus by the Difference of Latitude and Departure from the Meridian, you may keep a true Account by Longitude and Latitude, and prick it down upon the Globe, or any true Map, according to *Mercator*'s Projection, if you reckon it thus in short Di-

stances,

ſtances, as Seamen uſe to do from Noon to Noon.

You may work this alſo by Natural Sines.

As Coſ. 48 *deg.* 15 *min. to Rad.*

6659 10000

So 280 *miles, to* 420 $\frac{1}{2}$ *min.*

Of Sailing by Mercator's *Chart.*

HEre it will be neceſſary to have a Table of Meridional Parts, which I have drawn out of Mr. *Wright*'s Tables, to every tenth Minute of Latitude, accounting it in ſingle Miles or Minutes of the Equinoctial, the better to avoid Fractions, as he and Mr. *Norwood* have deſigned it.

A Table of Meridional Miles.

The Deg. of Lat.	0	10	20	30	40	50	The Difference.
	The Minutes of each Degree.						
	The Meridional Miles.						
0	0	10	20	30	40	50	[illegible]
1	60	70	80	90	100	110	[illegible]
2	120	130	140	150	160	170	[illegible]
3	180	190	200	210	220	230	[illegible]
4	240	250	260	270	280	290	[illegible]
5	300	310	320	330	340	350	[illegible]
6	360	370	380	390	400	410	[illegible]
7	421	431	441	451	461	471	[illegible]
8	481	491	501	511	521	532	[illegible]
9	542	552	562	572	582	592	[illegible]
10	603	613	623	633	643	653	[illegible]
11	664	674	684	694	704	715	[illegible]
12	725	735	745	755	766	776	[illegible]
13	786	797	807	817	827	838	[illegible]
14	848	858	869	879	889	900	10
15	910	920	931	941	951	962	10
16	972	983	993	1004	1014	1024	10
17	1035	1045	1056	1066	1077	1087	10
18	1098	1108	1119	1129	1140	1150	10
19	1161	1172	1182	1193	1203	1214	10
20	1225	1235	1246	1257	1267	1278	11
21	1289	1299	1310	1321	1332	1342	11
22	1353	1364	1375	1386	1396	1407	11
23	1418	1429	1440	1451	1462	1473	11
24	1484	1499	1505	1516	1527	1538	11
25	1549	1561	1572	1583	1594	1605	11
26	1616	1627	1638	1649	1661	1672	11
27	1683	1694	1705	1717	1728	1738	11
28	1751	1762	1773	1785	1796	1808	11
29	1819	1830	1842	1853	1365	1867	11

A Table of Meridional Miles.

The Deg. of Lat.	0	10	20	30	40	50	The Difference.
	The Minutes of each Degree.						
	The Meridional Miles.						
30	1888	1899	1911	1923	1934	1946	12
31	1958	1969	1981	1993	2004	2016	12
32	2028	2040	2052	2063	2075	2087	12
33	2099	2111	2123	2135	2147	2159	12
34	2171	2183	2195	2207	2219	2231	12
35	2244	2256	2268	2281	2293	2305	12
36	2318	2330	2342	2355	2367	2380	12
37	2392	2405	2417	2430	2442	2455	12
38	2468	2481	2493	2506	2519	2532	13
39	2544	2557	2570	2583	2596	2609	13
40	2622	2635	2648	2662	2675	2688	13
41	2701	2714	2728	2741	2754	2768	13
42	2781	2795	2808	2822	2835	2849	13
43	2863	2876	2890	2904	2918	2932	14
44	2945	2959	2973	2987	3001	3015	14
45	3030	3044	3050	3072	3086	3101	14
46	3115	3130	3144	3159	3173	3188	14
47	3202	3217	3232	3247	3261	3276	15
48	3291	3306	3321	3336	3351	3366	15
49	3382	3397	3412	3428	3443	3459	15
50	3474	3490	3505	3521	3537	3553	16
51	3568	3584	3600	3616	3632	3649	16
52	3665	3681	3697	3714	3730	3747	16
53	3763	3780	3797	3814	3830	3847	17
54	3864	3881	3899	3616	3933	3950	17
55	3968	3985	4003	4020	4038	4056	18
56	4074	4092	4110	4128	4146	4164	19
57	4182	4201	4219	4238	4257	4275	19
58	4294	4313	4332	4351	4370	4390	20
59	4409	4428	4448	4468	4487	4507	20

A Table of Meridional Miles.

The Deg. of Lat.	0	10	20	30	40	50	The Difference.
	The Minutes of each Degree.						
	The Meridional Miles.						
60	4527	4547	4567	4588	4608	4629	20
61	4648	4670	4691	4711	4733	4754	21
62	4775	4796	4818	4839	4861	4883	22
63	4905	4927	4949	4972	4994	5017	22
64	5039	5062	5085	5108	5132	5155	23
65	5179	5203	5226	5250	5275	5299	24
66	5324	5348	5373	5390	5423	5449	25
67	5474	5500	5520	5552	5678	5404	26
68	5631	5658	5685	5212	5739	5767	27
69	5795	5823	5021	5879	5908	5937	28
70	5966	5996	6125	6055	6085	6115	30
71	6146	6177	6208	6239	6271	6303	31
72	6335	6368	6401	6434	6468	6501	33
73	6535	6570	6605	6640	6675	6718	35
74	6747	6783	6820	6857	6895	6933	37
75	6972	7010	7050	7089	7130	7170	40
76	7211	7253	7295	7338	7381	7424	43
77	7469	7513	7559	7605	7651	7698	46
78	7746	7795	7844	7894	7944	7996	50
79	8048	8100	8154	8209	8204	8320	55
80	8377	8435	8495	8555	8616	8678	60
81	8742	8806	8872	8939	9007	9077	68
82	9148	9221	9295	9371	9449	9528	77
83	9609	9692	9778	9865	9954	10046	88
84	10141	10238	10338	10441	10547	10656	105
85	10770	10887	11007	11133	11263	11398	128
86	11539	11686	11839	11990	12168	12344	165
87	12521	12718	12927	13150	13388	13644	230
88	13920	14221	14550	14914	15321	15783	386
89	16318	16950	17726	18729	10152	22623	

The Use of this Table is after this manner.

Prop. 113.

Knowing the Latitudes of any two Places, to find the Meridional Miles or Minutes between them.

This Propoſition hath three Caſes.

Firſt, *When one Place is under the Equinoctial, and the other towards one of the Poles*; Then the Meridional Minutes anſwerable to that Place which hath Latitude, is to be reckoned for the Meridional Difference of Latitude, or the Latitude inlarged.

Secondly, *When both Places are towards one of the Poles*, Then ſubtract the Meridional Minutes anſwering to the leſſer Latitude, out of the Meridional Minutes belonging to the greater Latitude, the Remainer will be the Meridional Minutes required.

Thirdly, *If one Place have North Latitude, and the other South*; Add the Meridional Minutes belonging to each Place together, and the Sum thereof is the Meridional Minutes required.

Having thus found out theſe Meridional Minutes for any two Places, you may thus make uſe of them.

Prop.

Prop. 114.

By the Longitude and Latitude of two Places, to find the Rumb from the one to the other.

First find the Meridional Minutes between the two Latitudes; then,

As the Meridional Minutes contained between the two Places,
To their true difference of Longitude in Minutes,
So is the Radius,
To the Tangent of the Rumb leading from the one Place to the other.

Prop. 115.

By the Difference of Latitude, and the Rumb you have sailed upon, to find the Difference of Longitude.

First find the Meridional Minutes belonging to the Difference of Latitude; then,

As the Radius,
To the Tangent of the Rumb:
So the Meridional Minutes of Latitude,
To the true Minutes of Longitude, which you may divide by 60, and so turn into Degrees.

These are the two chief Propositions wherein this Table is useful, *viz.* To find the true Rumb and Distance between any two Places,

which

which in ſmall Diſtances may be performed by the Rules of Plain Sailing, as before ſhewed; eſpecially if you make uſe of *Prop.* 112. for the finding of the Longitude, which is ſomewhat more readily performed thereby, in caſting up your Dead Reckoning every day or two. Indeed this Table is only neceſſary to find the Rumb and Diſtance and Longitude of Places far diſtant; but the 107, 108, and 109. Propoſitions, which muſt be uſed in this manner of Sailing, and alſo are the moſt neceſſary for the keeping of an Account, muſt always be wrought by the true Difference of Latitude, and not by the Meridional Table.

I might make many various Queſtions and Examples out of theſe Rules; but theſe are as many as are of neceſſary and ordinary uſe, and by which all others may be performed.

OF

Of Circular Sailing, or Sailing by the Arch of a Great Circle.

THis though in some sense it is the most exact way of Sailing, shewing the nearest way and distance between any two Places; yet it is very difficult, and withal of little use. For Seamen do seldom keep their Course near this Arch, but are either drawn aside from it by some conveniences of Winds and Streams, as in sailing to the *West-Indies*, they hale away more to the Southward; or else they are forced from this Course by cross Winds, or interposition of some Head-lands or Islands: So that their best way is to keep their Account by the former Rules. Only having skill herein, they may see that it is many times the nearer way to leave the Rumb, and to sail more Northerly, as in sailing home from the *West-Indies*; which makes those that keep not a true Account by the former Rules, but reckon altogether by the Plain Chart, to be at the *Lands end* many Leagues before their Account. Also in a Parallel Course, as from the *Lands end* to *New-found-land*, you may see how you may advantage your selves by raising and depressing the Pole 10 or 12 Degrees, which will be a great help for the keeping your Account, and yet go

go a nearer way than if you ſhould ſail on the Parallel of Eaſt and Weſt.

But becauſe this may be more readily and plainly performed by Geometry, I ſhall refer you for this to my *Geometrical Seaman*, being lately inlarged, and made more practical, for the ready keeping of your Account by Latitude and Longitude, by new Tables for that purpoſe.

OF

OF MEASURING AND SURVEYING.

Prop. 116.

To measure a Board being a long Square.

First measure the breadth of the Board in Inches.. Then,

As 12 Inches or one Foot in breadth,
To 12 Inches or one Foot in length:
So the Inches of the breadth,
To the Inches of the length for one Foot.

Work by the backward Rule.

As 12, to 12: So 6, to 24.

Or else divide 144, the Inches in a Foot of Board, by the Inches of the breadth of the Board.

Some 144 divided by 8 Inches, shews 18 Inches make a Foot.

And 144 divided by 9 yields 16 Inches in a Foot.

And

And 144 *divided by* 18 *yields* 8 *Inches in a Foot.*

So by opening the Compasses to this distance, and turning them all along to the end of the Board, you may know how many Feet it is in length.

Another way.

Let your Ruler be divided into Feet, and Decimals of Feet instead of Inches; and measure the length and breadth of the Board therewith, and multiply the one by the other.

Example. *A Board is* 1 *Foot* 17 *parts broad, and* 16 *Foot* 32 *parts long, it contains* 19 *Foot and a tenth part of a Foot almost*, viz. 19,0944.

Prop. 117.

In Tiling Workmen reckon by the Square, which is 10 Foot every way, containing 100 Feet.

There is a Roof 16 *Foot* 25 *parts broad, how much thereof makes a Square?*

Divide 100 by 16.25, the Product will be *6* 154; that is, *6* Feet 154 parts.

Prop. 118.

A Barn hath the breadth of the Roof 15 Foot 25 parts, and the length of the Barn is 47 Foot, How many Squares of Tiling hath it?

Double the length (that you may count both Sides of the Roof) it makes 94 Feet; which multiplied by 16.25, yields 1527.5; which divided by 100, yield 15 Squares 27 Feet and an half over, which is a little above a quarter of a Square.

Prop. 119.

In Paving men reckon by the Yard Square; so each Yard hath 9 square Feet.

A certain Court or Yard hath 17 Feet 35 parts in breadth, and 30 Foot 5 parts in length; How many Square Yards doth it contain?

Multiply 17.35 by 30.5, the Product will be 529.175; which divided by 9, the Quotient will be 58.797, somewhat above 58 Yards 3 quarters.

Prop.

Prop. 120.

In meaſuring of Land, a Perch or Pole is 16 Feet and an half, and four Poles in breadth and 40 in length make an Acre; ſo that an Acre is 160 Poles.

Now to meaſure a ſquare piece of Land, multiply one of the Sides by the other Side joyning to it, and divide the ſum by 160.

A piece of Land being 40 *Poles one way, and* 20 *Poles another way, theſe multiplied make* 800 *Poles; which divided by* 160, *ſhews* 5 *Acres for the Content,* Or elſe,

As 160, *to the one Side* 40 *Poles:*
So the other Side 20 *Poles, to the Content in Acres,* 5 *Acres.*

Prop. 121.

To meaſure a Triangular piece of Land.

Meaſure the longeſt Side of the Triangle; and the Perpendicular from the Angle oppoſed to that long Side, and then multiply the half of the one by the whole of the other, and divide by 160.

Let the Side be 60, *the Perpendicular* 40; 60 *multiplied by* 20, *or* 40 *by* 30, *makes* 1200, *which divided by* 160, *yields* 7 *Acres and an half for the Contents.*

Or else you may multiply the Side 60 and the Perpendicular 40 together, they make 2400; and divide it by 320 (whose Log. is 2. 505150) which is the double of one Acre, it yields the same Content.

As 320, *to* 60: *So* 40, *to* 7, 50.

Prop. 122.

To measure a Trapezia, or a double Triangle.

Multiply both the Perpendiculars by half the Diagonal Line, which is the common Base of both the Triangles, and divide by 160.

Thus let the Diagonal line be 40, *one of the Perpendiculars* 15, *the other* 8; *these two added together make* 23, *which multiplied by half the Diagonal-line* 20, *make* 460; *which divided by* 160, *makes* 2 *Acres*, 3 *Reds* 20 *Poles.*

Or else,

As 320, *to the Sum of the two Perpendiculars* 23:
So the length of the Diagonal-line 40, *to the Content.*

Prop. 123.

To measure a Circular piece of Land.

Multiply half the Diameter by half the Circumference, and divide the Product by 160.

So the Diameter of the Circle being 140 *Poles, and the Circumference* 440 *Poles; the half of these two, being* 220 *and* 70, *multiplied together, produce* 15400 *Poles; which divided by* 160, *yield* 96 *Acres and a quarter.*

Or else, multiply the Diameter being 140 in it self, it makes 19600; which divided by 203.7 (whose Logarithm is 2,308951) makes 96 Acres 22 parts.

The Log. of 140	2,146128
Doubled makes	4,292256
Substr. 203. 7, *Log.*	2,308991
Rest Log. 96. 22.	1,983265

Prop. 124.

To measure an Oval piece of Ground.

Let the Oval be 30 Poles one way, and 40 Poles the other, What is the Content?

Multiply the length 40 by the breadth 30, it makes 1200; which divide by 203 $\frac{1}{10}$, it yields 5 Acres, 3 Roods, 23 Perches.

Prop. 125.

By this Number 203 $\frac{1}{10}$ you may also find the Acres contained in any half Circle, or quarter, or sixth part, or any such Section of

of a Circle, multiply the Semidiameter by the Compass line, and dividing by 203 $\frac{1}{10}$, whose *Log.* is 2.308991.

Prop. 126.

To measure Brick-work.

Brick-work is usually measured by the Rod or Pole, each Rod containing 16 Foot and an half; and a Brick wall of one Brick and an half thick being one Rod square, is accounted for a Rod of Brick-work; and 4500 Bricks will make such a Rod of Work.

Now these Walls or Sides of Houses must be first measured according to their form in length and breadth, according to Art, thereby to find out how many Rods they contain; and because a Rod is such a long measure, it will do best, as in measuring of Land, to divide the Rod into 10 parts, and so each of them into 10 lesser parts, making in all 100 parts, or 1000 if you will; and thus measuring the length and breadth (or rather the height) of any Wall, and multiplying them together, you shall have the Content in Rods, and 100 or 1000 parts of a Rod.

Example.

Let a Wall about an Orchard or Garden be 60 Rods in length, and half a Rod high, that is 50 parts of the Rod high How many Rods doth it contain?

The

The length, Rods	60	00
Multiplied by the breadth, Rods	00	50
Yields Rods	30	00

Again, *The Wall of an House being three*

Rods high,	03	00
And 12 Rods in compass,	12	00
Multiplied makes Rods	36	00

But now all Walls are not of this thickness; some are two Bricks, some three: To reduce Rods of such thickness to Rods of ordinary Work of one Brick and an half thick, work thus.

As the thickness of an ordinary Rod of Work reckoned in half Bricks, which is	3
To the thickness of any other Wall in half Bricks; viz. *two Bricks and an half, which makes* 5, *or any other thickness,*	5
So the number of Rods of the Content found by measure,	12
To the Rods which it will yield of ordinary Work of a Brick and an half thick.	20

Or for your more plain and ready use take this Table.

A Table

A Table to reduce a Brick-wall of any thickness to the Content of Ordinary Work which is a Brick and an half thick.

Measure of the Wall in Rods.	The thickness of the Wall, Bricks. 1		1½		2		2½		3		3½		4	
	The Content thereof reduced into Rods and parts. Rods.	Parts	Rods.	Parts	Rods.	Parts	Rods.	Parts	Rods.	Parts	Rods.	Parts	Rods.	Parts
1	0	67	1	00	1	33	1	67	2	00	2	33	2	67
2	1	33	2	00	2	67	3	33	4	00	4	67	5	33
3	2	00	3	00	4	00	5	00	6	00	7	00	8	00
4	2	67	4	00	5	33	6	67	8	00	9	33	10	67
5	3	33	5	00	6	67	8	33	10	00	11	67	13	33
6	4	00	6	00	8	00	10	00	12	00	14	00	16	00
7	4	67	7	00	9	33	11	67	14	00	16	33	18	67
8	5	33	8	00	10	67	13	33	16	00	18	67	21	33
9	6	00	9	00	12	00	15	00	18	00	21	00	24	00
10	6	67	10	00	13	33	16	67	20	00	23	33	26	67
11	7	33	11	00	14	67	18	33	22	00	25	67	29	33
12	8	00	12	00	16	00	20	00	24	00	28	00	32	00
13	8	67	13	00	17	33	21	67	26	00	30	33	34	67
14	9	33	14	00	18	67	23	33	28	00	32	67	37	33
15	10	00	15	00	20	00	25	00	30	00	35	00	40	00
16	10	67	16	00	21	33	26	67	32	00	37	33	42	67
17	11	33	17	00	22	67	28	33	34	00	39	67	45	33
18	12	00	18	00	24	00	30	00	36	00	42	00	48	00
19	12	67	19	00	25	33	31	67	38	00	44	33	50	67
20	13	33	20	00	26	67	33	33	40	00	46	67	53	33

Prop.

Prop. 127.

To measure a piece of Timber exactly square.

The usual way is to have a Line upon their Ruler, to shew how many Inches make a Foot for any Square. But it is as good a way, or better (especially if you cast it up with your Pen) to know how much one Foot length of any Square will yield in proportion to a Foot of Timber, which is to contain 1728 Cubick Inches; which you may do by this Rule.

If the Square of 12 *Inches, which is*	144
for every Foot length yield one Foot of Timber, or parts	1,000
What shall any other Square, as the Square of 6, *which is*	36
The Answer will be	0,250

Now multiply this by the number of Feet in length, and it yields the Content of the piece of Timber in Feet and parts. *As if this piece of Timber* 6 *Inches Square, were* 10 *Foot long, it would contain* 2 *Foot* 500 *parts, or an half.*

And thus you may draw out a Table for your more ready use, as you may see in my *Purchasers Pattern.*

Prop. 128.

To measure any kind of Timber, though it be not square, but of any form, as three square, four square, many square, round, or of any other fashion; provided it be straight and equal all along.

Cast up the Superficial Content at the end thereof, and find how many Inches it contains by the Geometrical Propositions before-going, for the finding the Content of the Triangle, long Square, many Square, round Circle, &c. and then work as before in the last.

As 144, *the Inches of the Superficial Content of the end or Side of a Cubick Foot.*
To a Cubick Foot containing 1000 *parts:*
So the Superficial Content of the end of any piece of Timber, let it be 100, 200, 300 *Inches,*
To the Solid Content of one Foot length thereof.

So you shall find for 100 Inches Content, 0,694 parts; for 200 Inches, the double thereof, 1,389; for 300, 2,083, that is, 2 Foot 083 parts; wwhich you may easily make into such a Table as this for your use.

A Table shewing the Solid Content of one Foot length of any piece of Timber, according to the Superficial Content at the end thereof.

The Inches of the Content at the end.	Feet.	parts.	*The Inches of the Content of the end.*	Feet.	parts.
1	0	007	200	1	398
2	0	014	300	2	083
3	0	021	400	2	778
4	0	028	500	3	472
5	0	035	600	4	167
6	0	042	700	4	861
7	0	049	800	5	559
8	0	056	900	6	250
9	0	062	1000	6	94[illegible]
10	0	069	2000	13	888
20	0	139	3000	20	833
30	0	208	4000	27	778
40	0	278	5000	34	7[illegible]
50	0	347	6000	41	666
60	0	417	7000	48	71[illegible]
70	0	485	8000	55	555
80	0	556	9000	62	500
90	0	625	10000	69	44[illegible]
100	0	694	20000	138	888

Prop. 129.

A more eaſie way for meaſuring round Timber.

Becauſe there is ſo much abuſe in the meaſuring of round Timber, I ſhall ſhew you ſomwhat a more plain and ready way for meaſuring of round Timber, which is only thus.

Take the compaſs thereof with a ſtring, and then meaſuring the ſtring by your Ruler, ſee how many Inches the Tree is in Compaſs, and then find thoſe Inches in the Table, and there you ſhall ſee how many Inches and parts of that Tree will make a Foot of Timber, which take out with your Compaſſes, and turn them over from one end to the other of the Tree, the ſeveral ſpaces will ſhew how many Feet of Timber is in that Tree.

Thus let the compaſs of a Tree be 60 *Inches; you ſhall find in the Table againſt* 60 *Inch. compaſs, that* 6 *Inch.* 03 *par. of an Inch, divided into* 100 *parts, makes a Foot of Timber; ſo that if the piece of Timber be* 12 *Foot long, there is very near* 24 *Foot of Timber in it; for* 12 *Foot and* 1 *Inch is ſomewhat more than* 24 *Foot.*

If the Tree exceed the compaſs of 100 Inc. (which is the greateſt number in the Table) then take half the compaſs, and find the number in the Table belonging thereunto, and divide it by 4; that is, take a quarter of that number; and ſo many Inches and parts will make a Foot of Timber of a Tree of that compaſs.

A Table shewing how many Inches in length make a Foot of Timber, of any Tree or round piece of Timber whose Compass is known.

Comp.	Inch.	par.	Comp.	Inc.	par	Comp.	Inc.	par.
10	217	15	41	12	92	71	4	31
11	179	46	42	12	31	72	4	20
12	150	80	43	11	74	73	4	08
13	128	49	44	11	41	74	3	97
14	110	79	45	10	72	75	3	86
15	94	31	46	10	26	76	3	76
16	84	82	47	9	83	77	3	66
17	75	14	48	9	42	78	3	57
18	67	02	49	9	04	79	3	48
19	60	15	50	8	69	80	3	39
20	54	29	51	8	35	81	3	31
21	49	23	52	8	03	82	3	23
22	44	86	53	7	73	83	3	15
23	40	90	54	7	42	84	3	08
24	37	69	55	7	18	85	3	01
25	34	74	56	6	92	86	2	94
26	32	12	57	6	68	87	2	87
27	29	79	58	6	45	88	2	80
28	27	70	59	6	24	89	2	74
29	25	82	60	6	03	90	2	68
30	24	13	61	5	84	91	2	62
31	22	60	62	5	65	92	2	57
32	21	21	63	5	47	93	2	51
33	19	92	64	5	30	94	2	46
34	18	78	65	5	14	95	2	41
35	17	74	66	4	98	96	2	36
36	16	76	67	4	84	97	2	31
37	15	86	68	4	70	98	2	26
38	15	04	69	4	56	99	2	22
39	14	28	70	4	43	100	2	17
40	13	57						

The Compass of the Tree in Inches.

The Compass of the Tree in Inches.

The Compass of the Tree in Inches.

Prop. 130.

To measure Tapering Timber.

Many times Timber is lesser at one end than the other, and most Trees or round Timber is so. Now the common way to measure such a piece of Timber, is to measure it by the square or compass taken in the middle thereof: but that gives the quantity a good deal too little; and the more tapering it is, so much the worse.

These pieces of tapering Timber are either parts of Cones or Pyramides. Now the way to measure a whole Cone or Pyramide is as in *Prop.* 53. 54. to multiply the superficial Content of the Base by a third part of the length. And the best and plainest way to measure these Sections, will be, as you may see in my *Purchasers Pattern*, first to find the length of the whole Pyramide or Cone, and so to find the Content thereof; then by the superficial Content at the lesser end, and the length which belongs to that part, find the Content thereof, as if it were a Cone or Pyramide of it self. Lastly, Subtract the Content of this lesser top-part from the Content of the whole, the Remainer must needs be the Content of the bigger bottom-part, which you were to measure.

Now

Now to find the length of the top-part of the Cone or Pyramide which is cut off.

Measure the Sides or Diameters of the two ends, and observe how much they differ from each other in breadth. Then,

As the Difference of the breadth of the two Ends,
To the length between them:
So the breadth of the greater end,
To the whole length of the Cone or Pyramide.

Or if this may seem difficult and tedious, you may part your piece of Timber as it were into several parts, 10 or 5 Foot long, and so measure each part according to its square or compass in the middle, and then add them all together. This will come very near; and you will find much difference between this, and measuring the whole piece at once by the middle.

Prop. 130.

To measure Tapering Timber.

Many times Timber is lesser at one end than the other, and most Trees or round Timber is so. Now the common way to measure such a piece of Timber, is to measure it by the square or compass taken in the middle thereof: but that gives the quantity a good deal too little; and the more tapering it is, so much the worse.

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Now

Now to find the length of the top-part of the Cone or Pyramide which is cut off.

Meaſure the Sides or Diameters of the two ends, and obſerve how much they differ from each other in breadth. Then,

As the Difference of the breadth of the two Ends,
To the length between them:
So the breadth of the greater end,
To the whole length of the Cone or Pyramide.

Or if this may ſeem difficult and tedious, you may part your piece of Timber as it were into ſeveral parts, 10 or 5 Foot long, and ſo meaſure each part according to its ſquare or compaſs in the middle, and then add them all together. This will come very near; and you will find much difference between this, and meaſuring the whole piece at once by the middle.

OF
GAGING.

THere is not much difference between Gauging and Measuring other Solids; only they are measured by Feet and Parts, these Vessels by Gallons, Quarts, and Pints.

There are two things herein chiefly necessary, yet both controverted. First, These Vessels being for the most part of irregular forms, how to reduce them to a regular Proportion. Secondly, To find the true quantity of the Gallon in Cubick Inches, or parts of a Foot.

For the first of these, one of the best ways is that of Mr. *Oughtred*'s. Measure the Diameter of the Cask both at the Bung and at the Head, and by their Diameters find out the Area of their Cricles. Then take two thirds of the Area at the Bung, and one third of the Area at the Head, and add them together; this will be the mean Area of the Vessel. Lastly, If you multiply this mean Area by the length of the Vessel, it will shew how many solid Inches the Vessel contains; which if you divide by the Number of solid Inches in one Gallon, it will shew

ſhew you how many Gallons the Cask will hold.

Example. *Suppoſe a Wine Cask, having the Diameter at the Head* 18 *Inches, and the Diameter at the Bung* 32 *Inches; and the length* 40 *Inches, What is the Content?*

$\frac{1}{3}$ *of the Area at the Head is*	84,823
$\frac{2}{3}$ *of the Area of the Bung are*	536,166
The Sum of theſe two	620,989
Multiplied by the length	40
Makes ſolid Inches	24839,560

which divided by the ſolid Inches in one Gallon of Wine, which are 231 *Inches, yields for the content* 107 *Gallons* 530 *parts, that is, ſomewhat above half a Gallon.*

But now here is the ſecond difficulty to reſolve how many ſolid Inches are in a Gallon.

As for the Wine Gallon, it hath been and ſtill is commonly received, that a Wine Gallon contains 231 Cubick Inches: yet Dr. *Wybard* pleads that it is ſomwhat leſs. *viz.* 224 or 225 at moſt. But this difference is not ſo much as others make it in the Ale Gallon; for though moſt old Gagers and the Coopers make the Ale Gallon to the Wine Gallon as 4 to 5; ſo that the Wine Gallon being 231 Inches, the Ale Gallon is 288 Inches $\frac{3}{4}$: yet ſince the Exciſe it is accounted by them but 282 Cubick Inches.

According to these Rules and Observations this Table is calculated, shewing the $\frac{1}{3}$ of the Area at the Head, and $\frac{2}{3}$ of the Area at the Bung, of any Cask ready cast up in Gallons and 1000 parts for Wine measure; so that measuring the Diameter of any Cask at the Head, and at the Bung, and adding these two Numbers together, and multiplying their Sum by the length of the Cask, you shall find the Content thereof in Wine Gallons.

Example. *Suppose the Diameters,*

As the Head to be 18 Inches	0,367
At the Bung to be 32 Inches	2,321
The Sum of these two	2,688
Multiplied by the length 40 Inches	40
Makes very near as before	107,520

that is, 107 *Gallons* 520 *parts of a Gallon, that is, a little above one half of a Gallon.*

A Table for the Gaging of Wine Cask.

	Head		Bung			Head		Bung	
	G.	parts	G.	parts		G.	parts	G.	parts
1	0	001	0	002	31	1	089	2	178
2	0	004	0	009	32	1	160	2	321
3	0	010	0	020	33	1	234	2	468
4	0	018	0	036	34	1	310	2	620
5	0	028	0	056	35	1	388	2	776
6	0	045	0	081	36	1	469	2	938
7	0	056	0	111	37	1	551	3	102
8	0	072	0	145	38	1	636	3	272
9	0	092	0	183	39	1	724	3	448
10	0	113	0	226	40	1	813	3	625
11	0	137	0	274	41	1	904	3	809
12	0	163	0	326	42	2	000	4	000
13	0	192	0	383	43	2	096	4	191
14	0	221	0	444	44	2	194	4	388
15	0	255	0	510	45	2	295	4	588
16	0	290	0	580	46	2	398	4	796
17	0	318	0	657	47	2	504	5	007
18	0	367	0	734	48	2	611	5	222
19	0	409	0	818	49	2	721	5	442
20	0	453	0	906	50	2	833	5	665
21	0	500	1	000	51	2	948	5	895
22	0	548	1	097	52	3	065	6	129
23	0	600	1	199	53	3	184	6	609
24	0	653	1	305	54	3	305	6	865
25	0	708	1	416	55	3	428	7	108
26	0	766	1	532	56	3	554	7	364
27	0	826	1	692	57	3	682	7	625
28	0	888	1	777	58	3	813	7	890
29	0	953	1	906	59	3	945	8	100
30	0	020	2	040	60	4	080		

You may inlarge this Table to parts of Inches, and draw it into a Gaging Line or Rod, and make the like also for Beer and Ale Gallons, as you may see at large in my *Purchasers Pattern.*

To

To Gauge a Cask which is not full.

A Table for the Gauging of Wine Casks which are not full.

G.	parts.	G.	parts.	G.	parts.	G.	parts.	G.	parts.
0	000	13	2630	26	4338	39	5913	52	7672
½	295		2703		4400		5976		7758
1	470	14	2775	27	4462	40	6040	53	7829
	602		2847		4542		6094		7909
2	720	15	2918	28	4585	41	6158	54	7990
	830		2986		4646		6223		8072
3	935	16	3056	29	4706	42	6288	55	8154
	1038		3123		4766		6353		8236
4	1138	17	3189	30	4826	43	6418	56	8319
	1235		3255		4885		6483		8404
5	1339	18	3321	31	4943	44	6548	57	8491
	1420		3387		5000		6613		8580
6	1502	19	3452	32	5057	45	6679	58	8661
	1596		3517		5115		6745		8765
7	1681	20	3582	33	5174	46	6811	59	8862
	1764		3647		5234		6877		8962
8	1846	21	3712	34	5294	47	6944	60	9065
	1918		3777		5354		7012		9170
9	2010	22	3842	35	5415	48	7082	61	9280
	2091		3906		5476		7153		9398
10	2171	23	3960	36	5535	49	7225	62	9530
	2242		4024		5600		7297		9705
11	2328	24	4087	37	5662	50	7370	63	10000
	2405		4150		5724		7444		
12	2481	25	4213	38	5787	51	7519		
	2556		4276		5850		7595		

The

The Use of this Table is thus.

First measure the Diameters of the Cask at the Head and Bung, and so find the Content of the whole Cask. Then measure how many Inches deep the Liquor is which is in the Cask, and then work by the Rule of Proportion.

Example. *Let the Cask be as before 32 Inches at the Bung, and the Liquor 24 Inches deep.*

As the Diameter at the Bung in Inches	32
To the depth of the Liquor in Inches	24
So the Radius of the Table	10000
To the part proportional	7500

Find this Number 7500 in the Table, and it answers very near to 50 Gallons three quarters.

Then work again thus, omitting the smaller Fractions, which are of little concernment.

	Gal.	*par.*
As the Gallons of the Radius	63	00
To the proportional Gallons found	50	75
So the Content of the whole Cask	107	50
To the Content of the Liquor being 24 Inches deep	86	61

that is, somewhat above 86 *Gallons and an half.*

To

To know the Content of any Wine or Beer Cask in Ale or Beer Gallons.

The London *Coopers Scantlings.*

For the Beer Barrel.

The Diameter at the Head	19 *Inches* 9 *par.*
The Diameter at the Bung	23 *Inches* 0 *par.*
The length	27 *Inches* 4 *par.*

For the Kilderkin.

The Diameter at the Head	16 *Inches* 1 *par.*
The Diameter at the Bung	18 *Inches* 6 *par.*
The Length	21 *Inches* 1 *par.*

These Scantlings do very well agree with the old received quantity of the Ale Gallon, which allows it be 288 Inches $\frac{3}{4}$, making the Barrel to be a Pint over 36 Gallons, and the Kilderkin a Pint and an half.

So that,

As 4, *to* 5:
So any number of Wine Gallons, to the Content of Wine Cask in Beer or Ale Gallons.

But upon later Experiments, it hath been resolved on by the Committee of Excise, that in the measuring of the Brewers Tuns and Vessels,

Veſſels, the Ale Gallon ſhould contain but 282 Cubick Inches.

Now for the meaſuring of thoſe Tuns, whether they be Square or Round, or of what form ſoever they are, you muſt do thus.

Firſt, you muſt find the Content of ſuch Tuns in ſolid or Cubick Inches, by the former Rules of Meaſuring ſuch Bodies; which dividing by 282, the Inches in one Gallon, ſhews the Content in Gallons; and dividing the Gallons by 36 (the Gallons in one Barrel) ſhews the Content in Barrels.

You may make this Work more ſhort and eaſie, if you provide a Table, which ſhall ſhew you how to reduce the Foot-meaſure of any Superficial Form into Barrels and Parts; So meaſuring the Superficial Content of the top or bottom of any Veſſel according to the Rules of Art, you ſhall have the Content in Barrels and Parts for one Inch deep; which being multiplied by the depth of the Veſſel, or the depth of the Liquor therein, ſhews the Content or Quantity of the ſaid Veſſel or Liquor.

There are two ſuch Tables for this purpoſe, the one for ſquare Tuns, the other for round Veſſels, in my *Purchaſers Pattern*; which, though ſhort, may eaſily be inlarged for ſuch as have need of them.

I ſhall here give you another ſhort Table, which ſhall be more general for all Forms, ſhewing

ſhewing the Content in Barrels and Parts for any number of Feet of Superficial Meaſure one Inch deep.

Note, One Foot ſquare is near half a Gallon; for there is 144 Inches in a Foot, which doubled makes 288, which ſhould be the Content of the Ale Gallon, though here it is a little leſſened to 282 Inches.

A Table to reduce Superficial Foot-measure into Barrels and 10000 parts.

F.	B.parts	F.	B.parts.	F.	B.parts.	F.	B. parts.
1	0.0142	29	0.4114	56	0.7924	83	1.1770
2	0.0284	30	0.4255	57	0.8086	84	1.1914
3	0.0426	31	0.4397	58	0.8228	85	1.2055
4	0.0567	32	0.4538	59	0.3369	86	1.2197
5	0.0709	33	0.4680	60	0.8510	87	1.2338
6	0.0851	34	0.4822	61	0.8652	88	1.2480
7	0.0993	35	0.4964	62	0.8794	89	1.2522
8	0.1135	36	0.5106	63	0.8935	90	1.2765
9	0.1277	37	0.5248	64	0.9076	91	1.2906
10	0.1418	38	0.5390	65	0.9218	92	1.3048
11	0.1560	39	0.5532	66	0.9360	93	1.3190
12	0.1702	40	0.5674	67	0.9502	94	1.3332
13	0.1844	41	0.5815	68	0.9644	95	1.3474
14	0.1986	42	0.5956	69	0.9786	96	1.3615
15	0.2128	43	0.6098	70	0.9929	97	1.3756
16	0.2269	44	0.6240	71	1.0069	98	1.3900
17	0.2411	45	0.6382	72	1.0211	99	1.4042
18	0.2553	46	0.6524	73	1.0353	100	1.4184
19	0.2695	47	0.6666	74	1.0495	200	2.8368
20	0.2837	48	0.6808	75	1.0637	300	4.2552
21	0.2978	49	0.6950	76	1.0778	400	5.6736
22	0.3120	50	0.7092	77	1.0920	500	7.0920
23	0.3262	51	0.7234	78	1.1062	600	8.5104
24	0.3404	52	0.7376	79	1.1204	700	9.9288
25	0.3546	53	0.7518	80	1.1347	800	11.3472
26	0.3688	54	0.7660	81	1.1488	900	12.7656
27	0.3830	55	0.7802	82	1.1630	1000	14.1840
28	0.3972						

Prop.

Prop. 131.

To Gage a Ship, and cast up how many Tuns her Burden is.

Meaſure the length of her Keel, the breadth at the Mid-ſhip Beam, and the depth of the Hold, and multiply theſe three one by the other, and divide the Product thereof by 100: So you ſhall find how many Tuns her Burden is.

Example. *Suppoſe a Ship, having the length of her Keel* 50 *Foot, and the breadth at the Mid-ſhip Beam* 20, *the depth in the Hold* 10 *Foot; How many Tuns will the Ship carry?*

Multiply 50 *by* 20, *it makes* 1000; *and that multiplied by* 10, *makes* 10000; *which divided by* 100, *cutting off the two laſt Figures, ſhews the Ships burden to be* 100 *Tuns.*

But this reckoning is only for the Kings Ships.

But the Merchants Ships, who give no allowance for Ordnance, Maſts, Sails, Cables, Anchors, which are all a Burden, but no Tunnage, you muſt divide your Product by 95: So the foreſaid Ship will be found to be 105 Tuns $\frac{25}{95}$ parts.

But this way of reckoning the Tunnage of Ships, though it may come near in ſome Ships, yet it may miſs much in others; for all

all Ships are not built of the ſame faſhion: therefore it is the beſt and trueſt way to caſt up the Content of the Ship more exactly according to the Rules of Art, with reſpect had to the Mold and Shape of the Ship, and ſo to find how many Cubick Feet the Ship doth contain; and every Cubick Foot of Water, according to ſome, weighs 55 pound *Averdupoiz*: But Dr. *Wybard* finds every Cubick Foot of Water to weigh 62 pound 588 parts. Now every Tun being 20 Hundred weight, and every 100 weight 112 pound, which make 2240 pound, divide this by 62 pound 588 parts, it makes 35 Foot 79 parts: So that about 36 Cubick Feet make a Tun weight.

But here take notice, If you thus meaſure a Ship within, you ſhall find the Content or Burden the Ship will hold or take in. If you meaſure the Ship on the out-ſide to her Light-mark, as ſhe ſwims being unladen, you ſhall have the weight or content of the empty Ship; and if you meaſure from this Light-mark to her full draught of Water being laden, that will be the true Burden or Tunnage of the Ship.

Prop.

Prop. 132.

Knowing the Measures of a Ship of one Burden, to make another Ship of the same Mold, which shall be double, or treble, or in any proportion, more or less, to the said Ship.

Multiply the Measures of the length, breadth, and depth of the Ship Cubically, and then double or treble the Cube, and extract the Cube Root thereof.

Example. *The Keel of the foresaid Ship being 50 Foot, and her Burden being 100 Tuns, to make another Ship like her of 200 Tuns Burden.*

The Cube of 50 is 12500, which doubled makes 250000, the Log. whereof is 5,397940, the third part whereof is 1,799313, which is the Log. of 63.00, which is the Cube root of the length of the Keel required, viz. *63 Foot.* The like you must do for the breadth and depth; which you may thus work by the Logarithms with much ease and readiness.

One Ship 100 Tuns, Log.	2,000000
The other 200 Tuns, Log.	2,301030
The Difference	0,301030
A third part thereof	0,100343
Added to one Ships Keel 50 foot	1,698970
Shews the other Keel 63.0	1,799313

OF

Of GUNNERY.

Prop. 133.

The Names of the Principal Members of a Piece of Ordnance.

THE out-side round about the Piece, is called the *Superficies of her Metal*; the Substance or whole mass of Metal, the *Body*; the hollowness or Concave Cylinder, the *Bore* or *Soul*; so much of her Bore as containeth the Powder and Shot, is the *Chamber* or *Charged Cylinder*; the Remainer, her *Vacant Cylinder*; the Spindals or Ears are called the *Trunnions*; the Pummel at her Coyle, the *Casacabel Deck*; the little Hole, the *Touch-hole*; all the Metal behind the Touch-hole, her *Breech* or *Coyle*; the greatest Ring at her Touch hole, her *Base-ring*; the next Ring above the Touch-hole, her *Reinforc't-ring*; the next to that, the *Trunnion Ring*; the Ring next the Month, her *Muzzle-ring*; the Ring between the Trunnion-ring and Muzzle-ring, her *Cornish-ring*; all the Rings and Circles about the Muzzle, the *Frieze*; the whole length, the *Chace*.

Here followeth a General Table of Gunnery; Shewing the Length and Weight of most usual *English* Ordnance, the Diameter and Weight of their Bullets, the Length and Breadth of their Ladles, and the Weight of Powder to Charge them, &c.

A Table of Gunnery.

The Names of the ſeveral Pieces of Ordnance.	*Guns length.* *Feet.*	*Guns length.* *Inches.*	*Guns weight.* *pounds.*	*Guns bore.* *Inches.*	*Guns bore.* *8 parts.*	*Bullets diameter* *Inches.*	*Bullets diameter* *8 parts.*
A Baſe	4	6	200	1	2	1	1
A Rabinet	5	6	300	1	4	1	3
A Falconet	6	0	400	2	2	2	2
A Falcon	7	0	750	2	6	2	5
Minion *ordinary*	7	0	800	3	0	2	7
Minion *largeſt*	8	0	1000	3	2	3	0
Saker *leaſt*	8	0	1400	3	4	3	2
Saker *ordinary*	9	0	1500	3	6	3	4
Saker *old ſort*	10	0	1800	4	0	3	6
Demiculver. *leaſt*	10	0	2000	4	2	4	0
Demiculver. *ord.*	11	0	2700	4	4	4	2
Demicul. *old ſort*	11	0	3000	4	6	4	4
Culverin *leaſt*	11	0	4000	5	0	4	6
Culverin *ordin.*	12	0	4500	5	2	5	0
Culverin *largeſt*	12	0	9800	5	4	5	2
Demican. *leaſt*	11	0	5400	6	2	6	0
Demican. *ordin.*	12	0	5000	6	4	6	1
Demican. *larg*	12	0	6000	6	6	6	3
Cannon Royal	12	[illegible]	[illegible]	8	0	7	4

A Table of Gunnery.

Bullets weight.	*Bullets*	*Ladles length.*	*Ladles*	*Ladles breadth*	*Ladles*	*Powders weight.*	*Powders*	*Shoots level.*	*Utmost random.*
pounds.	*ounces.*	*Inches.*	*8 parts.*	*Inches.*	*8 parts.*	*pounds.*	*ounces.*	*paces.*	*paces.*
0	5	4	0	2	0	0	8	60	600
0	8	4	1	2	4	0	2	70	700
1	5	7	4	4	0	1	4	90	900
2	8	8	2	4	4	2	4	130	1300
3	4	8	4	5	0	2	8	120	1200
3	12	9	0	5	0	3	4	125	1250
4	12	9	6	6	4	3	6	150	1500
6	0	10	4	6	6	4	0	160	1600
7	5	11	0	7	2	5	0	163	16[illegible]0
9	0	12	0	8	0	6	4	174	1740
10	11	12	6	8	0	7	4	175	1750
12	11	13	4	8	4	8	8	178	1780
15	0	14	2	9	0	10	0	180	1800
17	5	16	0	9	4	11	6	181	1810
20	0	16	0	10	0	11	8	183	1830
30	0	20	0	11	4	14	0	156	1560
[illegible]2	0	22	0	12	0	17	8	162	[illegible]620
36	0	22	6	2	6	18	0	18[illegible]	[illegible]800
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Prop. 134.

Of the different Fortifications of most Pieces of Ordnance.

There are three Degrees uſed in Fortifying each ſort of Ordnance, both Cannons and Culverins. Firſt, ſuch as are ordinarily fortified, which are called *Legitimate Pieces.* Secondly, ſuch whoſe Fortification is leſſened, which are called *Baſtard Pieces.* Thirdly, Double Fortified Pieces, or Extraordinary Pieces.

This Fortification is reckoned by the thickneſs of the Metal at the Touch-hole, at the Trunnions, and at the Muzzle, in proportion to the Diameter of the Bore.

The Cannons double Fortified have full one Diameter of their Bore in thickneſs of Metal at their Touch-hole, and $\frac{11}{16}$ at their Trunnions, and $\frac{7}{16}$ at their Muzzle. The leſſened Cannons have at their Touch-hole but $\frac{3}{4}$ or $\frac{12}{16}$ of the Diameter of their Bore in thickneſs of Metal, and $\frac{9}{16}$ at their Trunnions, and $\frac{5}{16}$ at their Muzzle. The ordinary Fortified Cannons have $\frac{7}{8}$ at the Touch-hole, $\frac{5}{8}$ at the Trunnions, and $\frac{3}{8}$ at the Muzzle. All the double Fortified Culverins, and all leſſer Pieces of that kind, have one Diameter and $\frac{1}{8}$ at the Touch-hole, $\frac{15}{16}$ at the Trunnions,

ons, and $\frac{2}{6}$ at the Muzzle. And the ordinary fortified Culverins are fortified every way as your double fortified Cannons; and the lessened Culverins, as the ordinary Cannons in all points.

Prop. 135.

How much Powder is fit for proof, and what for action, for any Piece of Ordnance.

For Cannons $\frac{4}{5}$ of the weight of their Iron Bullet for proof; but for service half the weight of the Iron Bullet is enough, especially for Iron Ordnance, which will not endure so much Powder as Brass Guns by one quarter. For Culverins, the whole weight of their Shot for proof, and for action $\frac{2}{3}$. For the Saker and Faulcon $\frac{4}{5}$ of the weight of their Shot; and for lesser Pieces the whole weight may be used in service till they grow hot, but then you may abate with discretion. For proof of these lesser Pieces you may take once and $\frac{1}{3}$ of the weight of their Bullet. Herein also must be regard to the strength and goodness of the Powder, which is to be ordinary Corn Powder.

Prop. 136.

To make Ladles to load your Guns with.

The Ladles are to be ſo proportioned for every Gun, that two Ladle-fulls of Powder may charge the Piece, which in general terms is thus.

The Breadth of all Ladles are to be two Diameters of the Shot, that ſo a third part of the Compaſs may be left open, for the Powder to fall freely out of the Ladle when you turn it the bottom upwards. The length of the Ladles muſt be ſomewhat different, according as the Piece is fortified.

For double fortified Cannons; the length of the Ladle may be two Diameters and an half of their ſhot, beſides ſo much as is neceſſary to faſten it to the head of the Ladle-ſtaff, which will require one Diameter more of Plate: but this is not reckoned to the length of the Ladle, becauſe it holds no Powder.

For ordinary Cannons, the Ladle muſt not exceed two Diameters of their Shot in length.

For Culverins and Demiculverins the Ladle may be three Diameters of their Shot, and three and an half for leſſer Guns, to load them at twice: If you will load them at once, you muſt double the length of the Ladle.

Obſerve

Obſerve this for a general Rule, That a Ladle 9 Balles in length, and two Balles in breadth, will hold the juſt weight of the Iron Shot in Powder.

But note, That Iron Ordnance muſt have but three quarters of the Charge of Braſs Ordnance.

Prop. 137.

To know what Bullet is fit to be uſed for any Gun.

It is convenient that the Bullet be ſomewhat leſs than the Bore of the Gun, that it may have vent in the diſcharge, and not ſtick and break the Piece. Now ſome think a quarter of an Inch leſs than the Bore will ſerve for all Guns; but this vent is too little for a Cannon, and too much for a Falcon. It is more rational and artificial to divide the Bore of the Gun into 20 equal parts, and let the Diameter of the Bullet be 19 of thoſe parts, according to which proportion the Table is calculated.

Prop. 138.

By knowing the weight of one Bullet, to know what any other Bullet will weigh.

It is a common Opinion, and very near to the truth, as you may ſee in Dr. *Wybard*'s *Tactometria*, That a Bullet of caſt Iron of four

Inches Diameter weighs nine pounds of *Avoirdupoiz* weights.

Now if an Iron Bullet of 4 Inches Diameter weigh *9 l.* what shall an Iron Bullet of 8 Inches Diameter weigh?

All Bullets have a Cubical proportion one to another. Now by plain Arithmetick, the Cube of 4 is *64*, and the Cube of 8 is 512. Therefore,

As 64, to 9 l. So 512, *to 72 l.*

How to perform it by Logarithms, you may see in the ninth Proposition.

But if the Bullets be of several Metals, you must know the proportion which one Metal hath to another, and so make a second Operation.

Example.

The proportion between Lead and Iron is as much as two to three: Now if you would know what either of these Bullets would weigh in Lead:

For the Bullet of 4 Inches Diameter,

As 2, to 3: So 9 l. to 13 l. $\frac{1}{2}$.

For the Bullet of 8 Inches Diameter,

As 2, to 3: So 72 l. to 108 l.

The proportion between Iron and Stone is as 3 to 8: But this is of hard Marble Stone which is fit for Bullets. And in shooting these Bullets, you need not use so much Powder as for Iron Bullets.

By

By the weight you may also find the Diameter of any Bullet of Lead, Iron, or Stone, or of any other Metal whose proportion is known.

The commonly received proportions for Metals are those.

Lead is to Iron as 2 to 3.
Lead is to Brass as 24 to 19.
Lead is to Stone as 4 to 1.
Iron is to Brass as 16 to 18.
Iron is to Stone as 3 to 8.

The more exact Proportions between Metals are these.

Suppose a Cube or Bullet of a certain bigness to weigh 100 l. weight; the like Cube or Bullet of any of these Metals or Things shall weigh as followeth, and have this proportion.

	li.	pts.		li.	pts.
Gold	100	00	*Brass*	47	37
Quickſilver	71	43	*Iron*	42	10
Lead	60	53	*Tin*	38	95
Silver	54	39	*Stone*	15	80
Water	05	68			

Now if you would know the bigness of the Bullet that will weigh thus much, you may find by the former Rules, That as a Bullet of Iron which weighs 9 l. hath 4 Inches Diameter; so a Bullet of Iron that weighs 42 l. hath 6 Inches $\frac{3}{4}$ Diameter; and that must be the magnitude of the Bullet which being cast of these several Metals will weigh as aforesaid.

In like manner you may find the weight of any other Solid Body, of different Metals, by these Proportions.

Example. *If a Cannon-Royal of Brass weighs* 8000 *l. weight, what shall a Cannon of Iron of the same length and thickness weigh?*

As 47. 37 *for the Brass, Log.*	3.67555
To 42. 10 *for the Iron*	3,62428
So the Brass Cannons weight 8000.	3.90309
The Sum, substr. the first	7,52737
To the weight of the Iron Can. 7110.	3,85186

I have here added the Proportion of Water to these Metals, according to Dr. *Wybard's* Experiment, who finds a Cubick Foot of Water to weigh *62 l.* 588 *parts*, though I find in others but 55 *l.* And by this you may know how much any Piece of Ordnance weighs less in the Water than in the Air: For any Solid Body loseth so much of its weight in the Water, as the quantity of that Body in Water weighs. So that Gold loseth in the Water 5 *l.* 68 *parts* in every Hundred; that is above an 18th part: Brass loseth 5 *l* 68 *parts* in 47 *l.* 37 *parts*; that is, above an eighth part; Iron loseth 5 *l.* 68 *parts* in 42 *l.* 10 *parts*; that is, above a seventh part. Thus you may give some guess how many Tuns may weigh a Ship being sunk, knowing her weight and lading before.

Once

Once again, If you invert these Proportions: Then if you have a Solid Body of any of these Metals, and would make another of the same form and fashion, which should be of the same weight; the Bigness or Magnitude thereof will have these Proportions.

Water	10000	*Brass*	1256
Stone	3641	*Silver*	1044
Tin	1458	*Lead*	0938
Iron	1349	*Quickssilver*	0795
	Gold	0568	

Prop. 139.

To know how far any Piece of Ordnance will shoot.

There is much difference in several Authors about this; but all agree in this, first, That the Bullet is carried from the mouth of the Piece more violently, and for a good space in a straight Line or Range: and afterward as it proceeds further, as the violent force of the Motion abateth, so the Bullet sinketh down by degrees, till it grazeth upon the ground. Now these two Motions are considered apart, or else joined together; but they are both of them somwhat the longer, according as the Piece is mounted higher from the Level to the Angle of 45 degrees, which is the outmost Random; and if you mount any Piece higher,

the Random of the Bullet will be ſhorter and ſhorter: So that if you could ſhoot exactly upright, the Bullet would fall down into the mouth of the Piece again.

The right Range of every Piece, being diſcharged in a Level, or parallel to the Horizon, is ſet down in the former Table, in which the Cannon exceeds not 185 Paces that is, 5 Foot to each Pace: ſome reckon much more; but then they count ordinary Steps or Paces of two Foot ½; and Batteries made with ſuch Pieces are uſually made at 100 or 120 ſuch Paces, at which diſtance they do the beſt Execution.

The utmoſt Random likewiſe of any Piece, that is, from the Platform to the firſt graze of the Bullet, I find by ſome to be about ten times the diſtance of the Right Range; and accordingly I have ſo ſet it down in the Table.

As for the Ranges to the other Degrees and Points of the Quadrant, I find theſe Tables in good Authors.

A

A TABLE OF

Right Ranges or Point Blanks.		Randoms, or the first Graze.	
The Degrees of the Pieces Mounture.	*The Right Range in Paces, 5 Foot to a Pace.*	*The Degrees of Mounture.*	*The Paces of the Random, 5 Foot to a Pace.*
0	192	0	192
1	209	1	298
2	227	2	404
3	240	3	510
4	261	4	610
5	273	5	722
6	285	6	828
7	302	7	934
8	320	8	1044
9	337	9	1129
10	354	10	1214
20	454	20	1917
30	693	30	2185
40	855	40	2289
50	1000	50	2283
60	1140	60	1792
70	1220	70	1214
80	1300	80	1000
90	1350	90	

The Use of the Table of Randoms.

This Table is rather proportional than real; for it cannot be ſuppoſed that all kind of Guns ſhould have a like Random, this Table beſt agreeing to Cannons and Culverings, and the greater ſort of Ordnance. And therefore to know the Random of any other Gun, you may firſt make a Shot or two at a certain Degree of Mounture; and meaſuring the diſtance thereof, you may by the Rule of Proportion find the Random of that Gun to any other Degree, and ſo make a Table thereof.

Example. *Suppoſe a Saker being mounted to* 5 *deg. ſhoots the Bullet* 416 *Paces, How far will it ſhoot being mounted to* 10 *deg.*

As 722, *the Tabular diſtance for* 5 *deg. of Mounture,*
To 416 *Paces, the diſtance found:*
So the Tabular diſtance for 10 *deg. of Mounture,* 1214.
To the diſtance required. Work by the Log. and you ſhall find *699* $\frac{1}{2}$ Paces.

And yet it is to be feared, this will not determine the buſineſs ſo exactly as it ſhould; and therefore it were a very good Work for ſome who have skill and opportunity, to make Trial by ſeveral Pieces, and to find the Randoms of them, and make more exact Tables for all our common ſort of *Engliſh* Ordnance.

I

I find that Mr. *Nye* in his Gunnery made ſome Experiments by a Saker to this purpoſe. The Saker was 8 Foot long, which he loaded with three pound of Powder, exactly weighing the Powder and the Wad every time, ramming it down with four equal ſtrokes as near as he could every time, but put no Wad upon the Bullet, becauſe the Piece was mounted; and thus he made four Shots, each of them half an hour after the other that the Piece might cool, and be of equal temper, and mounted his Piece to four ſeveral Degrees of Mounture, *viz.* 1 *deg.* 5 *deg.* 7 *deg.* 10 *deg* and found theſe Randoms:

At 1 *deg. the Random was* 225 *Paces.*
At 5 *deg. the Random was* 4 6 *Paces.*
At 7 *deg. the Random was* 505 *Paces.*
At 10 *deg. the Random was* 630 *Paces.*

According to which, he framed this Table of Randoms.

Deg.	*Paces.*	*Deg.*	*Paces.*
0	206	6	461
1	225	7	505
2	274	8	548
3	323	9	589
4	370	10	630
5	416		

Captain *Hexam* in his Book of Gunnery ſhews how by finding out the Random of a Cannon for the firſt Degree of Mounture, to find

find the Random for every Degree to 45 *deg.* which is the utmost Random, after this manner.

First, find out how many Paces the Cannon will shoot being laid level by the Metal (which he accounts for one Degree of Mounture) divide this distance by 50, and then multiply the Quotient by 11, and that will bring out the number of the greatest digression or difference between Range and Range; which being divided by 44, the Quotient shews the number of Paces which the Bullet will lose in the other Ranges from Degree to Degree.

Example.

A Battering Cannon being laid by the Metal will shoot his Bullet (saith he) 1000 *ordinary Paces, two Foot and an half to each Pace; which being divided by* 50, *your Quotient will give* 20, *which being multiplied by* 11, *it will give* 220 *Paces, which is the number of the next digression made in the second Degree; which* 220 *divided by* 44, *the number of the remaining Degrees, yields* 5. *which is the number of Paces to be diminished in each following Degree.* And according to this Rule this Table is framed.

A

A Table of Randoms to 45 Degrees, accounting 2 Foot ½ to the Pace.

The Degrees of Mounture.	Paces	diff.	The Degrees of Mounture.	Paces	diff.
0	0775	225	23	4685	110
1	1000	220	24	4795	105
2	1220	215	25	4900	100
3	1435	210	26	5000	95
4	1645	205	27	5095	90
5	1850	200	28	5185	85
6	2050	195	29	5270	80
7	2245	190	30	5350	75
8	2435	185	31	5425	70
9	2620	180	32	5595	65
10	2800	175	33	5560	60
11	2975	170	34	5620	55
12	3145	165	35	5675	50
13	3310	160	36	5725	45
14	3470	155	37	5770	40
15	3625	150	38	5810	35
16	3775	145	39	5845	30
17	3920	140	40	5875	25
18	4060	135	41	5900	20
19	5595	130	42	5920	15
20	4325	125	43	5935	10
21	4450	120	44	5945	5
22	4570	115	45	5950	

But

But this Table of *Alexander Bianco*, for all sorts of Ordnance, I account one of the best.

A Table of Randoms for the first six Points of the Gunners Quadrant.

	1	2	3	4	5	6
Falconet	375	637	795	885	892	900
Falcon	550	935	1166	1254	1309	1320
Minion	450	765	954	1026	1071	1080
Saker	625	1062	1325	1425	1487	1500
Demiculver.	725	1232	1537	1653	1725	1740
Culverin	750	1275	1590	1710	1785	1800
Demicannon	625	1062	1325	1425	1487	1500
Cannon of 7	675	1147	1431	1489	1606	1620
Double Cannon	750	1275	1590	1710	1785	1800

Of Shooting in Mortar-pieces.

AS Cannons and other Pieces of Ordnance are uſed for the moſt part to ſhoot forward near a Level; ſo Mortar-pieces are uſed for the moſt part to ſhoot upward, and at Random: and therefore the Random of theſe Pieces is very neceſſary to be known. And moſt of the Tables that I find hereof agree in their Randoms, though they are in a ſeveral dreſs; ſo that one would think this were fully and certainly known.

Mr. *Norton* and Captain *Hexam* make uſe of *Diego Uffano*'s Tables, the one for the 12 Points of the Quadrant, the other for every Degree, taking the one half of each Number, and ſo reducing it into Paces of 5 Foot.

A Table of Randoms for Mortar-pieces, to every Degree of the Quadrant.

The Degrees of Mounture.	*The Paces of the Random.*	*The Degrees of Mounture.*	*The Degrees of Mounture.*	*The Paces of the Random.*	*The Degrees of Mounture.*
0	100	89	23	480	66
1	122	88	24	490	65
2	143	87	25	500	64
3	164	86	26	510	63
4	185	85	27	518	62
5	204	84	28	525	61
6	224	83	29	531	60
7	24[illegible]	82	30	536	59
8	262	81	31	540	58
9	280	80	32	543	57
10	297	79	33	549	56
11	315	78	34	552	55
12	331	77	35	558	54
13	347	76	36	562	53
14	362	75	37	568	52
15	377	74	38	573	51
16	392	73	39	5 7	50
17	406	72	40	580	49
18	419	71	41	581	48
19	432	70	42	582	47
20	445	69	43	583	46
21	457	68	44	584	
22	469	67	45	585	

Diego Uffano's Table of Randoms for Mortar-pieces, to the 12 Points of the Gunners Quadrant.

583	570	534	463	377	248	100	
6	5	4	3	2	1	0	
.	.	.	.	.	.	.	⊙
6	7	8	9	10	11	12	
583	570	534	568	377	248	0	

Here, according to Mr. *Norton*'s and Captain *Hexam*'s Brass Figures hereof, (to represent this the more lively) I suppose the mortar to be placed at ⊙; the several Randoms are the Pricks in the middle Line, numbred with the Points of the Quadrant, forward and backward, unto which the several Randoms are set. The first Prick next to ⊙ shews how far the Bullet or Granado is shot from the Mortar, being levelled Point Blank, and this is 100 Paces. The second Prick is the Random when the Mortar is mounted one Point, that is 248 Paces; and so the Randoms increase to the sixth Point, which is the utmost Random, and is 583 Paces.

If the Mortar be mounted higher, to the 7, 8, 9, *&c.* Points, the Randoms decrease again, as before they did increase, which they suppose to be in such Proportion, that the Random of the seventh Point is equal to

to the Random of the fifth, and the Random of the eighth to the fourth, and of the ninth to the third; and so for the rest of the Points, as in the Table.

But here is a great mistake in these latter Randoms; for if you proceed thus, and make the Randoms equal to each other, according as they are distant from the sixth Point, which is the utmost Random, then the Random of the tenth Point will be equal to the Random of the second Point, and the Random of the eleventh to the Random of the first Point; and so the Random of the twelfth Point will be equal to the Random of the 0 Point, or the Level Random. which is 100 Paces from the Mortar, which is contrary to all Art and Reason. For if the Mortar be mounted to the twelfth Point, that is, bolt upright, the Bullet or Granado must rationally fall down again either upon or near unto the Mortar, and not 100 Paces off, as they make it by this supposition.

And though they have (as I suppose) seen the error hereof, yet they have made a very poor amends for it, by making the Random of the eleventh Point 248 Paces, and the Random of the twelfth 00, making the difference of this Random as much as two of the other, and so drowning the 100 Paces of the Level Random, as if they were nothing considerable.

The

The like error is in the Table of Randoms for every Degree, which makes the Random of the 89 *deg.* to be 100 Paces, and yet sets those reversed Degrees a Line forwarder than they should be; for 90 should be against 0, and so the Random of 90 *deg.* will be 100 Paces from the Mortar, which should be in or near the Mortar, as before-said.

And this error is so much the worse, because the Mortars are most used in Randoms above 45, where the chief error lies.

It were to be wished therefore that this were rectified by Experience and Trial made of several Mortars. All that I can do at present, is to give you Mr. *Norton*'s Experiment by a little Mortar that shot a Bullet of 5 Inches Diameter, the Chamber whereof at the Mouth was two Inches and an half Diameter, and three Inches deep; the Chace 10 Inches deep, which he laded with three ounces of Powder, and discharging it at several Mountures above 45 *deg.* found these Randoms.

The

	Deg.		Yards.	Diff.
	45		750	40
	50		710	35
	55		675	55
The Mounture.	60	*The Random.*	620	45
	65		575	95
	70		480	120
	75		360	90
	80		270	

These Differences are very unequal, which either shews there is some fault in the writing or Printing of them, or else that it is a difficult thing to charge a Piece equally, and to mount it to a certain Degree exactly, and either of these may cause as much difference as is in most of these. But yet I suppose the Experiment in general is more consonant to truth than the former Table; and therefore hereupon I shall frame another Table of Randoms, which I hope will be of good use, and not liable to the former Absurdity.

A Table of Randoms for Mortar pieces, according to Mr. *Norton*'s Obſervation, reckoned in Yards.

D. The Degrees of Mounture.	Yards. The Yards of the Random.	diff.	D. The Degrees of Mounture.	Yards. The Yards of the Random.	diff.
45	750	6	68	506	16
46	744	7	69	490	16
47	737	7	70	474	17
48	730	7	71	457	18
49	723	8	72	439	18
50	715	8	73	421	19
51	707	8	74	402	20
52	699	9	75	382	20
53	690	10	76	362	21
54	680	10	77	341	21
55	670	10	78	320	22
56	660	11	79	298	23
57	649	11	80	275	24
58	638	11	81	251	24
59	627	12	82	227	25
60	615	12	83	202	26
61	603	12	84	176	27
62	591	13	85	149	28
63	578	14	86	121	29
64	564	14	87	092	30
65	550	15	88	062	31
66	536	15	89	031	31
67	521		90	000	

According

According to this Table I have drawn a Geometrical Demonſtration of thoſe Randoms, whereby theſe things may be made more plain and viſible; which though it differs much from other Mens Schemes thereof, yet I doubt not but you will find it much nearer the truth, eſpecially for the Ranges above 45, which are chiefly neceſſary.

Alſo having made ſome Experiments hereof, I find that the Randoms of other Ordnance are very irregular and defective, eſpecially in their Randoms above 45 *deg.* but there being little uſe of thoſe Randoms, I ſhall let it alone at preſent, till ſome farther Obſervations are made thereof.

This error proceeds from the ſame cauſe as the other, *viz.* they do not reckon or proportion the firſt or Level Range among theſe Randoms above 45; and this makes moſt think that the utmoſt Random is not at 45 *deg.* but ſome make it at 42 or 43 *deg.* and ſome at 24: but it is certain, that the utmoſt Random muſt be at 45 *deg.* and if the Ranges above 45 are truly proportioned, they will be much different from the Degrees under 45, eſpecially towards the 90 Degree, as you ſee I have found it for the Mortar-piece.

The

The Use of this Table will be Explained by these two Propositions.

Prop. 140.

Suppose upon trial you find that your Mortar-piece, being mounted to 65 *deg. did send her Granado* 700 *Yards, and you desire to know how far it will send it at* 45 *Degrees of Mounture, which is the greatest Random.*

Look in the Table you shall find against 65 *deg.* 550 *yards*, and against 45 *deg.* 750 *yards*: Work thus by these Numbers, according to the Rule of Proportion,

As 550, *to* 750: *So* 700, *to* $954\frac{1}{2}$.

That is,

As 550, *to* 750: (*the Tabular distances for the said Degrees*:)

So 700 *the Distance found, To* $954\frac{1}{2}$ *the Distance required.*

Prop. 141.

Finding that a Mortar-piece, being mounted 69 *Degrees, sends a Granado* 600 *Yards, what Degree of Mounture must that Mortar have to send the Granado* 900 *Yards?*

Look in the Table, and against 69 *deg.* you shall find 490 *yards*; thereupon you may work thus by the Rule of Proportion.

As

As 600, *to* 490: *So* 900, *to* 735.

Look this Number in the Table, or the neareſt you can find to it, which is 737, and this ſtands againſt 47 *deg.* which ſhews that the Mortar muſt be mounted about 47 *deg.* *viz.* 57 *deg.* $\frac{2}{7}$, that ſo it may ſend the Granado 900 yards, according to your deſire.

I have here omitted the Degrees under 45, becauſe I ſuppoſe them uſeleſs, for theſe Mortar-pieces are not uſed for Battery, as Cannons, to ſhoot againſt a Wall, but to carry Granadoes and Fire-balls over a Wall: Now 45 *deg.* of Mounture being their utmoſt Random, if you would have them to carry ſhorter, it is more convenient to mount them higher than 45 *deg.* rather than lower; for elſe they will not do their intended Execution, and fall ſo perpendicularly upon an Houſe or Tower. But if you have any occaſion, or deſire to know the Randoms under 45 *deg.* you may make uſe of the former Table of *Uffano*'s, which I ſuppoſe is much nearer the truth for the Degrees under 45, than for the Degrees above 45, as I have demonſtrated to you before.

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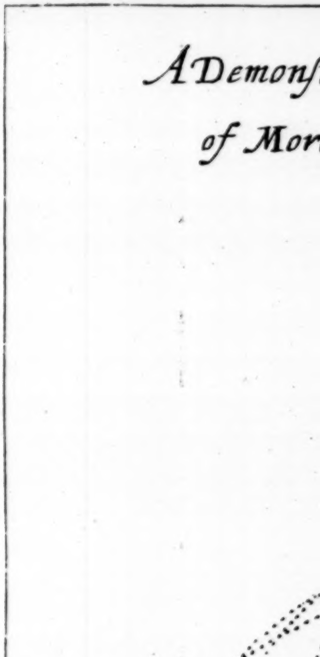

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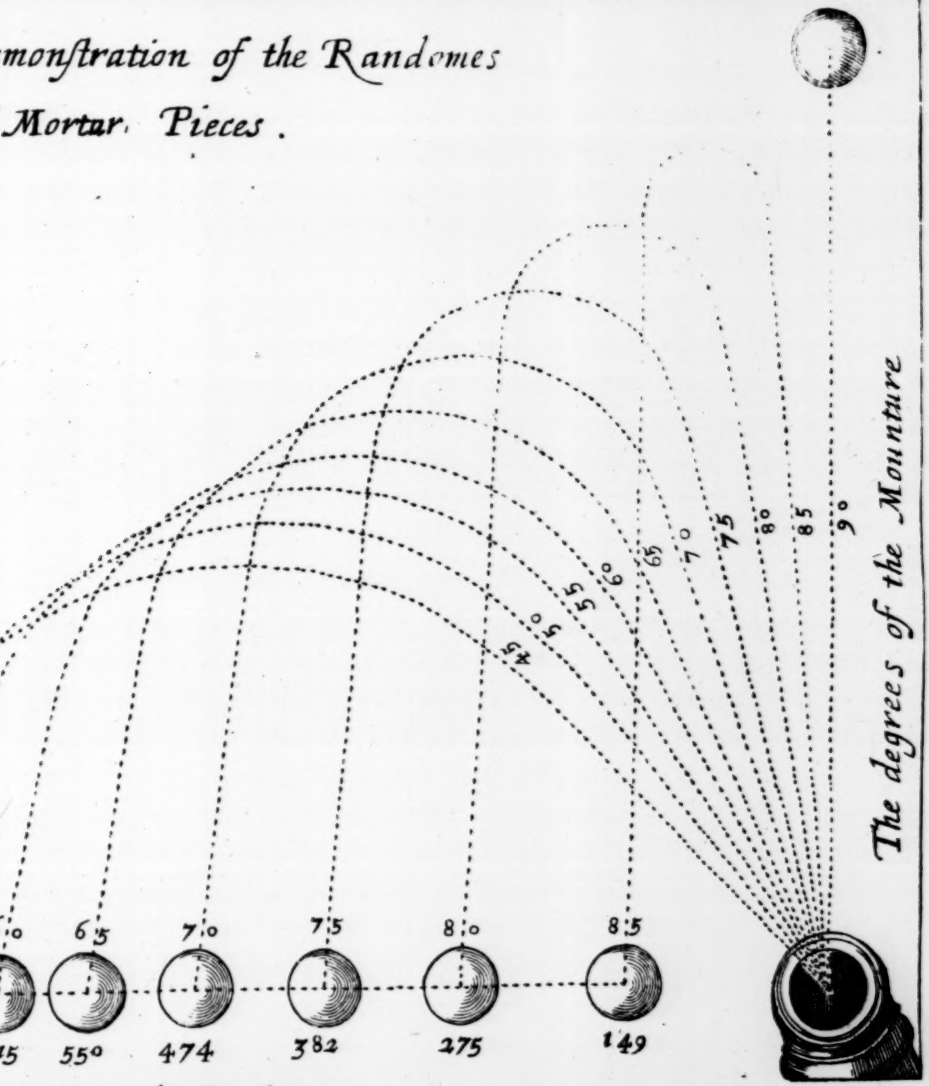
monſtration of the Randomes

Mortar Pieces.



yards of the Randome

place the Mortar piece page. 186. 187.

OF DIALLING.

Prop. 142. Dial 1.

To make a Dial upon an Equinoctial Plane.

AN Equinoctial Plane is that which lies parallel to the Equinoctial, and is an Horizontal Plane under the Pole. This is the first and plainest kind of all Dials, and is made by drawing a Circle as large as the Plane will well allow, and dividing it into 24 equal parts or Hours, which you may ſubdivide into Halfs and Quarters, and ſet up a Stile or Wyre directly upright in the Center. Every Hour is 15 *deg.* the half Hour 7 *deg.* 30 *min.*

This Dial may be made to ſet to any Latitude, and of good uſe to Seamen.

Prop. 143. Dial 2.

To make a Dial upon a Polar Plane.

A Polar Plane is one that lies parallel to the Pole, and is an Horizontal Dial under the Equinoctial.

The way to make this, is to draw a Meridian Line cross the midst of the Plane, and cross it at Right Angles with the Line of East and West. Then according to the breadth of the Plane you may proportion your Stile, whose Height must be equal to the Hour of III: but you may find its Height also by any other Hour-line, according to the Hours you would have it contain, by this Rule.

As the Tangent of the Hour-line 4 or 5,
To the Distance thereof from the Meridian line:
So the Radius,
To the Height of the Stile.

Then for the other Hour lines,

As the Radius,
To the Height of the Stile:
So the Tangent of any other Hour-line,
To the Distance thereof from the Meridian-line.

These Hour-lines must be all drawn parallel to the Hour of XII.

The Stile may be either a straight Pin or Needle set upright, or a Wyre made to lie parallel to the Plane over the Hour of XII, according to the Height aforesaid.

Prop. 144 Dial 3, 4.

To make a Dial upon a Meridian Plane, which is an East or West Dial.

A meridian Plane stands upright directly in the Meridian, and hath two Faces, one toward

ward the East, the other toward the West.

To make Dial on this Plane, first from the lower Corner on the North side of the Plane, according to the Latitude of the Place draw a Line which may lie parallel to the Equinoctial; then towards the upper Side of the Plane, on the South side, draw another line cross the former at Right Angles, which may point directly to the Pole of the World. This Line must stand for the Hour of VI, and must be the place of your Stile or Substile; and having found a convenient length for the Height of your Stile, as in the foregoing Proposition, the Distance of the Hour-lines will be found answerable thereunto, and must be drawn parallel to the Hour of VI, as before they were to the Hour of XII.

As the Radius,
To the Height of the Stile:
So the Tangent of any Hours Distance from Six,
To the Distance thereof from the Substile.

Prop. 145. Dial. 5.

To make an Horizontal Dial.

This is one of the most common and best sort of Dials, especially in our oblique Hemisphere, which being well placed in an open Place, shews all the Hours of the Day from Sun-rising to Sun-set.

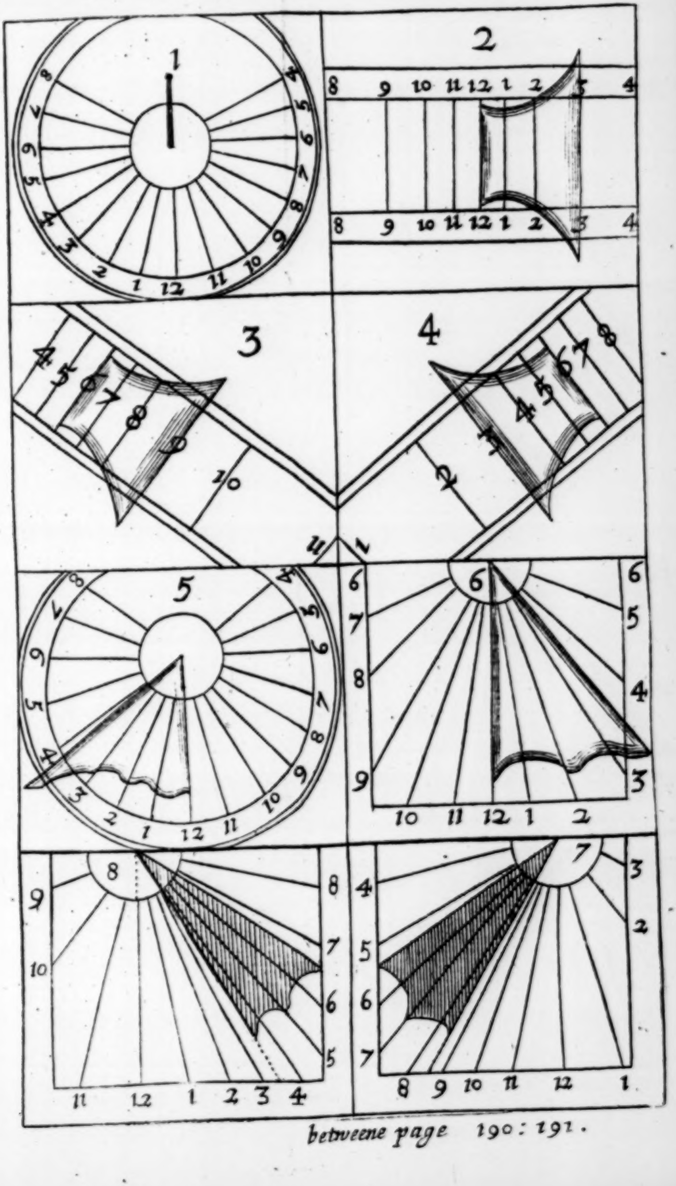
To make it, first draw a Line cross the middle of the Plane for the Meridian or Hour of XII; then cross this Line a little beyond the Center with the Line of E. and W. which is to be the Hour of VI. The intersection of these two Lines you must reckon for the Center of your Dial, and thereon describe an occult Circle for the drawing your Hour-lines by, which you must proportion according to the Latitude of the Place, by this Rule,

As the Radius,
To the Sine of the Latitude:
So the Tangent of the Hour from Noon,
To the Tangent of the Hour-line from the Meridian-line.

The Stile must be fixed just over the Meridian-line, and make an Angle from the Plane, equal to the Height of the Pole. The Hours before VI in the Morning, and after VI in the Evening, may be supplied by their opposite Hours on the other side the Center.

Because these kind of Dials are of so great use, I have taken this Table out of *Longomontanus* wherein the Hour-lines are calculated for many Latitudes.

A



betweene page 190: 191.

An Horizontal Dial, Latitude.
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60

A Table ſhewing the Diſtance of the Hour-lines from the Meridian in theſe Degrees of Latitude.

An Horizontal Dial, Latitude.	The Hours from the Meridian.												A South Erect Dial, Latitude.
	xi.	i	x.	ii	ix.	iii	viii.	iv	vii.	v	vi		
	D	M	D	M	D	M	D	M	D	M	D	M	
30	7	38	16	6	26	34	40	54	61	49	90	0	60
31	7	51	16	34	27	14	41	42	62	28	90	0	59
32	8	4	17	1	27	53	42	30	63	6	90	0	58
33	8	17	17	27	28	34	43	17	63	45	90	0	57
34	8	30	17	54	29	13	44	5	64	42	90	0	56
35	8	43	18	20	29	49	44	46	64	56	90	0	55
36	8	56	18	45	30	25	45	28	65	27	90	0	54
37	9	9	19	9	31	1	46	9	65	58	90	0	53
38	9	21	19	34	31	37	46	50	66	29	90	0	52
39	9	23	19	57	32	9	47	26	66	55	90	0	51
40	9	46	20	20	32	40	48	1	67	20	90	0	50
41	9	58	20	43	33	14	43	37	67	45	90	0	49
42	10	10	21	7	33	47	49	13	68	11	90	0	48
43	10	22	21	29	33	17	49	44	68	32	90	0	47
44	10	34	21	50	33	46	50	14	68	53	90	0	46
45	10	43	22	12	35	15	50	45	69	14	90	0	45
46	10	54	22	33	35	44	51	16	69	37	90	0	44
47	11	5	22	33	36	10	51	43	69	53	90	0	43
48	11	16	23	12	36	35	52	9	70	10	90	0	42
49	11	26	23	32	37	1	52	35	70	28	90	0	41
50	11	36	23	51	37	27	53	1	70	43	90	0	40
51	11	46	24	9	37	50	53	24	70	58	90	0	39
52	11	56	24	26	38	13	53	46	71	12	90	0	38
53	12	5	24	44	38	36	54	8	71	27	90	0	37
54	12	14	25	2	38	59	54	30	71	41	90	0	36
55	12	23	25	18	39	18	54	50	71	53	90	0	35
56	12	32	25	33	39	38	55	9	72	4	90	0	34
57	12	46	25	49	39	58	55	28	72	16	90	0	33
58	12	48	26	5	40	18	55	46	72	27	90	0	32
59	13	56	26	19	40	36	56	1	72	38	90	0	31
60	13	34	26	32	40	53	56	18	72	47	90	0	30

Prop. 146. Dial 6.

To make a Direct South Dial.

This Dial must stand upright, having its Plane or Face directly opposite to the South. The Making thereof is in a manner the same with the Horizontal. The Meridian-line must be drawn perpendicular just in the midst of the Plane; the Center of the Dial near the top thereof; the Height of the Stile must be an Angle equal to the Complement of the Pole; and the Hour-lines must be drawn according to its Height above the Plane, which you may either take out of the former Table, or Calculate them by the Rule of the last Proposition.

As the Radius,
To the Cosine of the Latitude:
So the Tangent of the Hour from Noon,
To the Tangent of the Hour-line from the Meridian.

Prop. 147. Dial 7. 8.

To make an upright Declining Dial.

These Dials are to be set on the side of an House; which though they may be Southerly, yet most times they decline either to the East or West, more or less.

In

In these Dials the Meridian-line is always a Perpendicular, drawn either in the midst of the Plane (or rather somwhat beside the midst) in the top whereof is the Center of the Dial, where the Substile and Hour-lines all meet.

In the making of these Dials there are these four things necessary to be found out.

First, The Angle or Distance of the Substile from the Meridian. Thus,

As the Radius, To the Cotangent of the Latitude:
So the Sine of the Declination of the Plane,
To the Tangent of the Substiles Distance from the Meridian-line.

2. The Height of the Stile above the Substile. Thus,

As the Radius, To the Cosine of the Declination:
So the Cosine of the Latitude, To the Sine of the Height of the Stile above the Substile.

3. The Difference between the Meridian of the Plane, and the Meridian of the Place. Thus,

As the Sine of the Latitude, To the Radius:
So the Tangent of the Declination, To the Tangent of the Difference of the Meridians.

4. The Angles of the Hour-lines from the Substile-line, which is the Meridian of the Plane. Thus,

As the Radius, To the Sine of the Height of the Stile above Plane :
So the Tangent of the Hour-line from the Meridian of the Plane, To the Tangent of the Hour-line from the Subſtile.

For Example hereof, Let us ſuppoſe the Dial *Fig.* 7. declining 45 *deg.* to the Eaſtward in the Latitude of *London*, which is about 51 *deg.* 30 *min.* were to be made.

1. *As the Radius*	10,00000
To the Cotang. of the Latitude 51. 30	9,90060
So the Sine of the Declination of the Plane 45.	9,84948
To the Tangent of 29 *d.*21 *m.*	19,75009

which is the Diſtance of the Subſtile from the Meridian.

2. *As the Radius*	10,000000
To the Coſine of the Declination 45	9,84948
So the Coſine of the Latitude 51. 30	9,794149
To the Sine of 26 *d.* 7 *m.*	19,643634

which is the Height of the Stile above the Subſtile.

3. *As*

3. *As the Sine of the Latitude 51 30 Compl. Arith.*	0,106456
To the Radius (which may be left out)	10,000000
So the Tangent of the Declination 45 d.	10,000000
To the Tangent of 51 d. 57 m.	10,106456

which is the Difference of Meridians; that is the Difference of Time which is between the Hour-line of 12, which is the Meridian of the Place, and the Substile line, which is the Meridian of the Plane or Dial.

Now lastly, To find the Distance of the Hour-lines from the Substile, which is the Meridian of the Plane; we have found that the Meridian of the Plane differs from the Meridian of the Place 51 *d.* 57 *m.* according to which you must make a Table for the Distance of the other Hour-lines, by adding or subtracting 15 *d.* for every Hour before and after 12 out of this Difference of Meridians, which here is 51 *d.* 57 *m.* until you come to the Substile, and then you must add the Complement of 15 *d.* on the other side the Substile, for the Hour next following, and 15 *d.* for every Hour after: So you shall have the Distance of all the Hours from the Substile; and then according to these equal Angles of the Hours, you must

find the ſeveral Arches which may be correſpondent thereunto upon the Plane by the fourth Section, which is common in all Dials, *viz.*

As the Radius,
To the Sine of the Height of the Stile:
So the Tangent of the Angle of the Hour,
To the Tangent of the Arch of the Hour-line from the Subſtile.

All theſe things you may collect into a Table after this manner.

	deg.	min.
The Latitude of the Place	51	30
The Declination of the Plane	45	00
The Diſtance of the Subſtile	29	21
The Height of the Stile	26	07
The Difference of Meridians	51	57

The

The East Decliner.						The West Decliner					
The Hours.		The Hour-Angles.		The Hour-Arches.		The Hours.		The Hour-Angles.		The Hour-Arches.	
h.	m.	d.	m.	d.	m.	h.	m	d.	m.	d.	m
3	0	83	3	74	31	10	0	81	57	72	27
4	0	68	3	47	31	11	0	66	57	45	58
5	0	53	3	30	20	12	0	51	57	29	21
6	0	38	3	19	01	1	0	36	57	18	19
7	0	23	3	10	37	2	0	21	57	10	3
8	0	8	3	3	34	3	0	6	57	2	26
Sub-stile.		Sub-stile.		Sub-stile.		Sub-stile.		Sub-stile.		Sub-stile.	
9	0	6	57	2	26	4	0	8	3	3	34
10	0	21	57	10	3	5	0	23	3	10	37
11	0	36	57	18	19	6	0	38	3	19	01
12	0	51	57	29	21	7	0	53	3	30	20
1	0	66	57	45	58	8	0	68	3	47	31
2	0	81	57	72	27	9	0	83	3	74	31

Here you may take notice, That having by these Rules found the Distances of the Hour-lines for an East Decliner, you may by converting the Hours find the said Distances for a West Decliner; as you may see by comparing

paring this Table and the Dial, Number 8, together.

But note here, Though I have ſet down the Hour of 3 in the Morning for the Eaſt Decliner, and the Hour of 9 in the Evening for the Weſt Decliner; yet theſe Lines muſt not be drawn upon the Dials; for the Sun is not then above the Horizon in that Latitude, and the Lines will fall above the Horizontal-line of the Plane, either of which may ſerve to direct you what Hours to ſet upon your *D*ial: but yet they are of uſe to draw the oppoſite Hours of 3 in the Afternoon in the Eaſt Decliner, and 9 in the Morning in the Weſt Decliner, which at ſome times of the Year will be uſeful upon the ſaid Dials.

Laſt of all, If the Face of your Dial be to the Northward, you muſt turn the Dials the bottoms upward, and reckon the Hours the contrary way; ſo the South Eaſt Decliner will be a North Eaſt Decliner, and the South Weſt Decliner will be a North Weſt Decliner, leaving out the Hour-lines (which will be needleſs) before the Sun-ſetting, and after the Sun-riſing.

There are many other ſorts of Inclining, Declining, and Reclining Dials, which I omit, being not ſo common and neceſſary as theſe. Alſo for the drawing the Azimuths, Almicanters, Signs of the Zodiack, Unequal Hours, and the Hours from Sun-riſe or ſet, for

for these you must consult larger Treatises, which are very well explained and applied, with several Schemes and Figures for the understanding thereof, by Mr. *Gunter*, Mr. *Wells*, Mr. *Foster* and many others.

As for Instrumental Dials, as Quadrants, Rings, Cylinders, which depend upon the Suns Height, I have added the two following Tables of Mr. *Gunters*, whereby his Quadrant and all such Instruments may be made for the finding of the Hour and Azimuth in the Latitude of *London*; whereby also you may take the Declination of any Wall or Plane, and so make a Dial upon it.

A

A Table of the Altitude of the Sun in the beginning of each Sign, for all the Hours of the Day, for the Latitude of *London*, being 51 *d.* 30 *m.*

Hours.		Cancer.		Gemine. Leo.		Taurus. Virgo.		Aries. Libra.		Pisces. Scorpio.		Aquar. Sagit.		Capricorn.	
		D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
12		62	0	58	43	50	0	38	30	27	1	18	18	15	0
11	1	59	43	56	34	48	12	36	58	25	40	17	6	13	52
10	2	53	45	50	55	43	12	32	37	21	51	13	38	10	30
9	3	45	42	43	06	36	0	26	7	15	58	8	12	5	15
8	4	36	41	34	13	27	31	18	8	8	33	1	15		
7	5	27	41	24	56	18	18	9	17	0	06				
6	6	18	11	15	40	9	0	0	0						
5	7	9	32	6	50	0	0							11	37
4	8	1	22											12	40

A Table of the ☉ Altitude in the beginning of each Sign, for every tenth Azimuth, for *London*.													
Azimuth.	♋		♌	♊	♍	♉	♎	♈	♏	♓	♐	♒	♑	
Degr.	D.	M.	D.	M.	D.	M	D.	M.	D.	M.	D.	M.	D.	M
South.	62	0	58	42	50	0	38	30	27	0	18	18	15	0
10	61	45	58	24	49	38	38	4	26	30	17	45	14	25
20	60	51	57	28	48	33	36	46	25	0	16	5	12	41
30	59	52	55	52	46	40	34	34	22	27	13	15	9	45
40	57	20	53	29	43	55	31	21	18	48	9	14	5	34
50	54	3	50	12	40	11	27	5	13	58	3	57	0	6
60	49	56	45	53	35	23	21	41	8	0				
70	44	40	40	25	29	27	15	13	1	0				
80	28	11	33	46	21	29	7	52						
90	30	38	26	10	14	25	0	0						
100	22	27	18	2	6	45							6	12
110	14	14	9	58									12	18
120	6	34	2	30									18	8

Distance from the South.

A TABLE OF Artificial Sines AND TANGENTS To every DEGREE and MINUTE OF THE QUADRANT.

The Common Radius being 10,000000.

LONDON:

Printed in the Year MDCLXXXIII.

Degree 0

M	Sine	Co-sine	Tangent	Co-tang.	
0	0.000000	10.000000	0.000000	*Infinita.*	60
1	6.463726	9.999999	6.463726	13.536274	59
2	6.764756	9.999999	6.764756	13.235244	58
3	6.940847	9.999999	6.940847	13.059153	57
4	7.065786	9.999999	7.065786	12.934214	56
5	7.162696	9.999999	7.162696	12.837304	55
6	7.241877	9.999999	7.241878	12.758122	54
7	7.308824	9.999999	7.308825	12.691175	53
8	7.366816	9.999999	7.366817	12.633183	52
9	7.417968	9.999999	7.417970	12.582030	51
10	7.463726	9.999998	7.463727	12.536273	50
11	7.505118	9.999998	7.505120	12.494880	49
12	7.542906	9.999997	7.542909	12.457091	48
13	7.577668	9.999997	7.577272	12.422328	47
14	7.609853	9.999996	7.609857	12.390143	46
15	7.639816	9.999996	7.639826	12.360180	45
16	7.667844	9.999995	7.667849	12.332151	44
17	7.694173	9.999995	7.694179	12.305821	43
18	7.718977	9.999994	7.719003	12.281997	42
19	7.742477	9 999993	7.742484	12.257516	41
20	7.764754	9.999993	7.764761	12.235239	40
21	7.785943	9.999992	7.785951	12.214049	39
22	7.806146	9.999991	7.806145	12.193845	38
23	7.825451	9.999990	7.825460	12.174540	37
24	7.843034	9.999989	7.843944	12.156056	36
25	7.861662	9 999989	7.861674	12.138326	35
26	7.878695	9.999988	7.878708	12.121292	34
27	7.895085	9.999987	7.895099	12.104901	33
28	7.910879	9.999986	7.910894	12.089106	32
29	7.926119	9.999985	7.926134	12.073866	31
30	7.940842	9.999983	7.940858	12.059142	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 89.

Degree 0.

M	Sine	Co-sine	Tangent	Co-tang.	
30	7.940842	9.999983	7.940858	12.059142	30
31	7.955082	9.999982	7.955100	12.044900	29
32	7.968870	9.999981	7.968889	12.031111	28
33	7.982233	9.999980	7.982253	12.017747	27
34	7.995198	9.999978	7.995215	12.004781	26
35	8.007787	9.999978	8.007810	11.992191	25
36	8.020021	9.999976	8.020044	11.979956	24
37	8.031919	9.999975	8.031945	11.968055	23
38	8.043601	9.999973	8.043527	11.956473	22
39	8.054781	9.999972	8.054809	11.945181	21
40	8.065776	9.999971	8.065806	11.934194	20
41	8.076500	9.999969	8.076531	11.923469	19
42	8.086965	9.999968	8.086997	11.913003	18
43	8.097183	9.999966	8.097217	11.902783	17
44	8.107167	9.999964	8.107203	11.892797	16
45	8.116926	9.999963	8.116963	11.883037	15
46	8.126471	9.999961	8.126510	11.873490	14
47	8.135810	9.999959	8.135851	11.864149	13
48	8.144953	9.999958	8.144996	11.855004	12
49	8.153907	9.999956	8.153952	11.846048	11
50	8.162681	9.999954	8.162737	11.837273	10
51	8.171280	9.999952	8.171328	11.828672	9
52	8.179713	9.999950	8.179763	11.820237	8
53	8.187985	9.999948	8.188036	11.811964	7
54	8.196102	9.999946	8.196156	11.803844	6
55	8.204070	9.999944	8.204126	11.795674	5
56	8.211895	9.999942	8.211953	11.788047	4
57	8.219581	9.999940	8.219641	11.780359	3
58	8.22713[illegible]	9.999938	8.227195	11.772805	2
59	8.234557	9.999936	8.234621	11.765379	1
60	8.241855	9.999934	8.241921	11.758079	0
	Co-sine	Sine	Co tang	Tangent	M

Degree 89.

Degree 1.

M	Sine	Co-sine	Tangent	Co-tang.	
0	8.241855	9.999934	8.241921	11.758079	
1	8.249033	9.999932	8.249102	11.750898	
2	8.256094	9.999929	8.256165	11.743835	
3	8.263042	9.999927	8.263115	11.736885	
4	8.269881	9.999925	8.269956	11.730044	
5	8.276614	9.999922	8.276691	11.723309	
6	8.283243	9.999920	8.283323	11.716677	
7	8.289773	9.999918	8.289856	11.716144	
8	8.296207	9.999915	8.296292	11.703708	
9	8.302546	9.999913	8.302634	11.697366	
10	8.308794	9.999910	8.308884	11.691116	
11	8.314954	9.999907	8.315046	11.684954	
12	8.321027	9.999905	8.321122	11.678878	
13	8.327016	9.999902	8.327114	11.672886	
14	8.332924	9.999899	8.333025	11.666975	
15	8.338753	9.999897	8.338856	11.661144	
16	8.344504	9.999894	8.344610	11.655390	
17	8.350180	9.999891	8.350289	11.649711	
18	8.355783	9.999888	8.355895	11.644105	
19	8.361315	9.999885	8.361430	11.638570	
20	8.366777	9.999882	8.366895	11.633105	
21	8.372171	9.999879	8.372292	11.627708	
22	8.377499	9.999876	8.377622	11.622378	
23	8.387762	9.999873	8.382889	11.617111	
24	8.387962	9.999870	8.388092	11.611908	
25	8.393101	9.999867	8.393234	11.606766	
26	8.398179	9.999864	8.398315	11.601685	
27	8.403199	9.999861	8.403338	11.596662	
28	8.408161	9.999858	8.408304	11.591696	
29	8.413068	9.999854	8.413213	11.586787	
30	8.417919	9.999851	8.418063	11.581932	
	Co-sine	Sine	Co tang.	Tangent	M

Degree 88.

g.	
979	
898	
835	
885	
44	
809	
77	
44	
08	
66	
16	
54	4
78	4
86	4
75	4
44	4
90	4
11	4
05	4
70	4
05	40
8	3
8	3
1	3
8	3
6	3
	34
	33
	32
	31
	30
	M

	8.4
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	8.4
	8.4
	8.4
	8.4
	8.4
	8.4
46	8.4
47	8.4
48	8.
49	8.
50	8.
51	8.9
52	8.9
53	8.
54	8.
55	8.
56	8.
57	8.
58	8.
59	8.
60	8.
	C

	Sine	Co-sine	Tangent	Co-tang.	
	8.417919	9.999851	8.418068	11.581932	30
	8.422717	9.999848	8.422869	11.577131	29
	8.427462	9.999844	8.427618	11.572382	28
	8.432156	9.999841	8.432315	11.567685	27
	8.436800	9.999838	8.436962	11.563038	26
	8.441394	9.999834	8.441560	11.558440	25
	8.445941	9.999831	8 446110	11.553990	24
	8.450440	9.999827	8.450613	11.549387	23
	8.454893	9.999824	8.455070	11.544930	22
	8.459301	9.999820	8.459481	11.540519	21
	8.463665	9.999816	8.463849	11.536151	20
	8.467985	9.999812	8.468172	11.531828	19
	8.472263	9.999809	8.472454	11.527546	18
	8.476498	9.999805	8.476693	11.523307	17
	8.480693	9.999801	8.480892	11.519108	16
	8.484848	9.999797	8.485050	11.514950	15
46	8.488963	9.999794	8.486170	11.510830	14
47	8.493040	9.999790	8.483250	11.506750	13
48	8.497078	9.999786	8.497293	11.502707	12
49	8.501080	9.999782	8.501298	11.498702	11
50	8.505045	9.999778	8.505267	11.494733	10
51	8.508974	9.999774	8.509200	11.490800	9
52	8.512867	9.999769	8.513098	11.486902	8
53	8.516726	9.999765	8.516961	11.483039	7
54	8.520551	9.999761	8.520790	11.479210	6
55	8.524343	9.999756	8.524586	11.475414	5
56	8.528102	9.999753	8.528349	11.471651	4
57	8.531828	9.999748	8.532080	11.467620	3
58	8.535523	9.999744	8.535779	11.464221	2
59	8.539186	9.999740	8.539447	11.460553	1
60	8.542819	9.999735	8.543084	11.456916	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 2.

M	Sine	Co-sine	Tangent	Co-tang.	
0	8.542819	9.999735	8.543084	11.456916	60
1	8.546422	9.999731	8.546691	11.453309	59
2	8.549995	9.999726	8.550268	11.449732	58
3	8.553558	9.999722	8.553817	11.446183	57
4	8.557054	9.999717	8.557336	11.442664	56
5	8.560540	9.999713	8.560827	11.439172	55
6	8.563999	9.999708	8.564291	11.435709	54
7	8.567431	9.999703	8.567727	11.432272	53
8	8.570836	9.999699	8.571137	11.428863	52
9	8.574214	9.999694	8.574520	11.425480	51
10	8.577566	9.999689	8.577877	11.422123	50
11	8.580892	9.999685	8.581208	11.418792	49
12	8.584193	9.999680	8.584514	11.415486	48
13	8.587469	9.999675	8.587795	11.412205	47
14	8.590721	9.999670	8.591051	11.408949	46
15	8.593948	9.999665	8.594283	11.405717	45
16	8.597152	9.999660	8.597492	11.402508	44
17	8.600332	9.999655	8.600677	11.399323	43
18	8.603488	9.999650	8.603838	11.396161	42
19	8.606622	9.999645	8.606978	11.393022	41
20	8.609734	9.999640	8.610094	11.389906	40
21	8.612823	9.999635	8.613189	11.386811	39
22	8.615891	9.999629	8.616262	11.383738	38
23	8.618937	9.999624	8.619313	11.380687	37
24	8.621967	9.999619	8.622343	11.377657	36
25	8.624965	9.999614	8.625352	11.374648	35
26	8.627948	9.999608	8.628340	11.371660	34
27	8.630911	9.999603	8.631308	11.368692	33
28	8.633854	9.999597	8.634456	11.365744	32
29	8.636776	9.999592	8.637184	11.362816	31
30	8.639679	9.999586	8.640093	11.359907	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 87.

Degree 2.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
30	8.639679	9.999586	8.640093	11.359907	30
31	8.642563	9.999581	8.642982	11.357017	29
32	8.645428	9.999575	8.645853	11.354147	28
33	3.648274	9.999570	8.648704	11.351296	27
34	8.651102	9.999564	8.651538	11.348463	26
35	8.653911	9.999558	8.654352	11.345648	25
36	8.656702	9.999553	8.657149	11.342851	24
37	8.659475	9.999547	8.659928	11.340072	23
38	8.662230	9.999541	8.662689	11.337311	22
39	8.664968	9.999535	8.665433	11.334567	21
40	8.667689	9.999529	8.668160	11.331840	20
41	8.670393	9.999523	8.670869	11.329130	19
42	8.673080	9.999518	8.673563	11.326437	18
43	8.675751	9.999512	8.676239	11.323761	17
44	8.678405	9.999506	8.678899	11.321100	16
45	8.681043	9.999499	8.681544	11.318456	15
46	8.683665	9.999493	8.684172	11.315828	14
47	8.686272	4.999487	9.686784	11.313216	13
48	8.688892	9.999481	9.689381	11.310619	12
49	8.691438	9.949475	9.691963	11.308037	11
50	8.693998	9.999469	8.694529	11.305471	10
51	8.696543	9.999462	8.697081	11.302919	9
52	8.699073	9.999456	8.699617	11.300383	8
53	8.701589	9.999450	8.702139	11.297861	7
54	8.704090	9.999443	8.704646	11.295354	6
55	8.706576	9.999437	8.707130	11.292860	5
56	8.709049	9.999431	8.709618	11.290381	4
57	8.711507	9.999424	8.712083	11.287917	3
58	8.713952	9.999418	8.714534	11.285466	2
59	8.716383	9.999411	8.716972	11.283028	1
60	8.718800	9.999404	8.719396	11.280604	0
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 87.

Degree 3.

M	Sine	Co-sine	Tangent	Co-tant.	
0	8.718800	9.999404	8.719396	11.280604	60
1	8.721204	9.999398	8.721806	11.278194	59
2	8.723595	9.999391	8.724254	11.275796	58
3	8.725972	9.999384	8.726588	11.273412	57
4	8.728336	9.999378	8.728959	11.271041	56
5	8.730688	9.999371	8.731317	11.268683	55
6	8.733027	9.999364	8.733663	11.266337	54
7	8.735354	9.999357	8.735996	11.264004	53
8	8.737667	9.999350	8.738317	11.261683	52
9	8.739969	9.999343	8.740626	11.259374	51
10	8.742259	9.999336	8.742922	11.257078	50
11	8.744536	9.999329	8.745207	11.254793	49
12	8.746801	9.999322	8.747479	11.252521	48
13	8.745955	9.999315	8.749740	11.250240	47
14	8.751297	9.999308	8.751989	11.248011	46
15	8.753528	9.999301	8.754227	11.245773	45
16	8.755747	9.999294	8.756453	11.243542	44
17	8.757955	9.999286	8.758668	11.241332	43
18	8.760151	9.999279	8.760872	11.239128	42
19	8.762337	9.999272	8.763065	11.236935	41
20	8.764511	9.999265	8.765246	11.234754	40
21	8.766675	9.999257	8.767417	11.232583	39
22	8.768828	9.999250	8.769578	11.230422	38
23	8.770970	9.999242	8.771727	11.228273	37
24	8.773101	9.999235	8.773866	11.229134	36
25	8.775223	9.999227	8.775995	11.224005	35
26	8.777333	9.999220	8.778114	11.221886	34
27	8.779434	9.999212	8.783[illegible]22	11.219778	33
28	8.781524	9.999204	8.782320	11.217680	32
29	8.783605	9.999197	8.784404	11.215592	31
30	8.785675	9.999189	8.786486	11.213514	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 86.

Degree 3

M	Sine	Co-sine	Tangent	Co-tang.	
30	8.785675	9.999189	8.786486	11.213514	30
31	8.787736	9.999181	8.788554	11.211446	29
32	8.789787	9.999174	8.790613	11.209387	28
33	8.791828	9.999166	8.792662	11.207338	27
34	8.793859	9.999158	8.794701	11.205299	26
35	8.795881	9.999150	8.796731	11.203269	25
36	8.797894	9.999142	8.798752	11.201248	24
37	8.799897	9.999134	8.800763	11.199237	23
38	8.801891	9.999126	8.802765	11.197235	22
39	8.803876	9.999118	8.807458	11.195242	21
40	8.805852	9.999110	8.806742	11.193258	20
41	8.807819	9.999102	8.808717	11.191283	19
42	8.809777	9.999094	8.812683	11.189317	18
43	8.811726	9.999086	8.812641	11.187359	17
44	8.813667	9.999077	8.814589	11.185411	16
45	8.815598	9.999069	8.816529	11.183471	15
46	8.817522	9.999061	8.818461	11.181539	14
47	8.819436	9.999052	8.820384	11.179616	13
48	8.821342	9.999044	8.822298	11.177702	12
49	8.823240	9.999036	8.824205	11.175795	11
50	8.825130	9.999027	8.826103	11.173897	10
51	8.827011	9.999019	8.827992	11.172008	9
52	8.828884	9.999010	8.829874	11.170126	8
53	8.830749	9.999002	8.831748	11.168252	7
54	8.832106	9.998993	8.833613	11.166387	6
55	8.834456	9.998984	8.835471	11.164529	5
56	8.836297	9.998976	8.837321	11.162679	4
57	8.838130	9.998967	8.839163	11.160837	3
58	8.839956	9.998958	8.840998	11.159002	2
59	8.841774	9.998940	8.842825	11.157175	1
60	8.843585	9.998941	8.844644	11.155356	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 86.

Degree 4.

M	Sine	Co-sine	Tangent	Co-tang.	
0	8.843584	9.998941	8.844644	11.155356	60
1	8.845387	9.998931	8.846455	11.153545	59
2	8.847183	9.998923	8.848240	11.151740	58
3	8.848971	9.998914	8.850057	11.149943	57
4	8.850751	9.998905	8.851846	11.148154	56
5	8.852525	9.998896	8.853628	11.146372	55
6	8.854291	9.998887	8.855403	11.144597	54
7	8.856049	9.998878	8.85717[illegible]	11.142829	53
8	8.857801	9.998869	8.858932	11.141068	52
9	8.859546	9.998860	8.860686	11.139314	51
10	8.861283	9.998851	8.862433	11.137567	50
11	8.863014	9.998841	8.864173	11.135827	49
12	8.864738	9.998832	8.865906	11.134094	48
13	8.866454	9.998823	8.867632	11.132368	47
14	8.868165	9.998813	8.869351	11.130649	46
15	8.869868	9.998804	8.871064	11.128936	45
16	8.871565	9.998795	8.872750	11.127230	44
17	8.873255	9.998785	8.874469	11.125531	43
18	8.874938	9.998776	8.876162	11.123838	42
19	8.876615	9.998766	8.897849	11.122151	41
20	8.878285	9.998757	8.879529	11.120471	40
21	8.879949	9.998747	8.881202	11.118798	39
22	8.881607	9.998738	8.882869	11.117131	38
23	8.883258	9.998728	8.884530	11.115470	37
24	8.884903	9.998718	8.886185	11.113815	36
25	8.886542	9.998708	8.887833	11.112167	35
26	8.888174	9.998699	8.889476	11.110524	34
27	8.889801	9.998689	8.891112	11.108888	33
28	8.891421	9.998679	8.892742	11.107258	32
29	8.893035	9.998669	8.894366	11.105634	31
30	8.894643	9.998659	8.845984	11.104016	30
	Co-sine	Sine	Co tang.	Tangent	M

Degree 85.

Degree 4.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	8.894643	9.998659	8.895984	11.104016	30
31	8.896246	9.998649	8.897596	11.102404	29
32	8.897842	9.998639	8.899203	11.100797	28
33	8.899432	9.998629	8.900803	11.099197	27
34	8.901017	9.998619	8.902398	11.097602	26
35	8.902596	9.998609	8.903987	11.096013	25
36	8.904169	9.998599	8.905570	11.094430	24
37	8.905736	9.998589	8.907147	11.092853	23
38	8.907297	9.998577	8.908719	11.091281	22
39	8.908853	9.998568	8.910285	11.089715	21
40	8.910404	9.998558	8.911846	11.088154	20
41	8.911949	9.998548	8.913401	11.086599	19
42	8.913488	9.998537	8.914951	11.085049	18
43	8.915022	9.998527	8.916495	11.083505	17
44	8.916550	9.998516	8.918034	11.081966	16
45	8.918073	9.998506	8.919568	11.080432	15
46	8.919591	9.998495	8.921096	11.078904	14
47	8.921103	9.998485	8.922619	11.077381	13
48	8.922610	9.998474	8.924136	11.075864	12
49	8.924112	9.998464	8.925649	11.074351	11
50	8.925609	9.998453	8.927156	11.072844	10
51	8.927100	9.998442	8.928658	11.071342	9
52	8.928587	9.998431	8.930155	11.069845	8
53	8.930068	9.998421	8.931647	11.068353	7
54	8.931544	9.998410	8.933134	11.066866	6
55	8.933015	9.998399	8.934616	11.065384	5
56	8.934481	9.998388	8.936093	11.063907	4
57	8.935942	9.998377	8.937565	11.062435	3
58	8.937398	9.998366	8.939032	11.060968	2
59	8.938850	9.998355	8.940494	11.059506	1
60	8.940296	9.998344	8.941952	11.058048	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 85.

Degree 5.

M	Sine	Co fine	Tangen.	Co-tang
0	8.940296	9.998344	8.941952	11.058048
1	8.941738	9.998333	8.943404	11.056596
2	8.943174	9.998322	3.944852	11.055148
3	8.944606	9.998311	8.946295	11.053705
4	8.946034	9.998300	8.947734	11.052266
5	8.957456	9.998289	4.949168	11.050832
6	8.958814	9.998277	8.950597	11.049403
7	8.950287	9.998266	8.952021	11.047979
8	8.951696	9.998255	8.953441	11.046559
9	8.953099	9.998243	8.954856	11.045144
10	8.954499	9.998232	8.956267	11.043733
11	8.955894	9.998220	8.957674	11.042326
12	8.957284	9.998209	8.959075	11.040925
13	8.958670	9.993197	8.960473	11.039527
14	8.960052	9.998186	8.961866	11.038134
15	8.961429	9.998174	8.963254	11.036746
16	8.962801	9.998163	8.964639	11.035361
17	8.964170	9.998151	8.966019	11.033981
18	8.965534	9.998139	8.967394	11.032606
19	8.966893	9.998128	8.968766	11.031234
20	8.968249	9.998106	8.970133	11.029867
21	8.969600	9.998104	8.971495	11.028505
22	8.970947	9.998092	8.972855	11.027145
23	8.972289	9.998080	8.974209	11.025791
24	8.973626	9.998068	8.975560	11.024440
25	8.974962	9.998056	8.976906	11.023094
26	8.976293	9.998044	8.978248	11.021752
27	8.977619	9.998032	8.979586	11.020414
28	8.978941	9.998020	8.980921	11.019079
29	8.980259	9.998008	8.982251	11.017749
30	8.981573	9.997996	8.983577	11.016423
	Co fine	Sine	Co-tang.	Tangent

Degree 84.

M	Sine	Co-sine	Tangen.	Co tang.	
30	8.981573	9.997996	8.983577	11.016423	30
31	8.982883	9.997984	8.984899	11.015101	29
32	8.984189	9.997971	8.986217	11.013783	28
33	8.985491	9.997959	8.987532	11.012468	27
34	8.986789	9.997947	8.988842	11.011158	26
35	8.988083	9.997935	8.990149	11.009851	25
36	8.989374	9.997922	8.991451	11.008549	24
37	8.990660	9.997910	8.992750	11.007250	23
38	8.991943	9.997897	8.994045	11.005955	22
39	8.993228	9.997885	8.995337	11.004663	21
40	8.994497	9.997873	8.996624	11.003376	20
41	8.995768	9.997860	8.997908	11.002092	19
42	8.997036	9.997847	8.999188	11.000812	18
43	8.998299	9.997835	9.000465	10.999535	17
44	8.999560	9.997822	9.001738	10.998262	16
45	9.000816	9.997809	9.003007	10.996993	15
46	9.002069	9.997797	9.004272	10.995728	14
47	9.003318	9.997784	9.005534	10.994466	13
48	9.004563	9.997771	9.006792	10.993208	12
49	9.005805	9.997758	9.008047	10.991953	11
50	9.007044	9.997737	9.009298	16.990702	10
51	9.008278	9.997732	9.010546	10.989454	9
52	9.009510	9.997719	9.011790	10.988210	8
53	9.010737	9.997706	9.013031	10.986969	7
54	9.011962	9.997693	9.014268	10.985732	6
55	9.013182	9.997680	9.015502	10.984498	5
56	9.014399	9.997667	9.016732	10.983268	4
57	9.015613	9.997654	9.017959	10.982041	3
58	9.016824	9.997641	9.019183	10.980817	2
59	9.018031	9.997628	9.020403	10.979597	1
60	9.019235	9.99761[illegible]	9.021620	10.978380	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 84.

Degree 6.

M	Sine	*Co-sine*	Tangent	*Co-tang*	
0	9.019235	9.997614	9.021620	10.978380	60
1	9.020435	9.997601	9.022834	10.977166	59
2	9.021632	9.997588	9.024044	10.975956	58
3	9.022825	9.997574	9.025251	10.974749	57
4	9.024016	9.997561	9.026455	10.973545	56
5	9.025203	9.997548	9.027655	10.972345	55
6	9.026386	9.997534	9.028852	10.971148	54
7	9.027567	9.997520	9.030 46	10.969954	53
8	9.028744	9.997507	9.031237	10.968763	52
9	9.029918	9.997493	9.032425	10.967575	51
10	9.031089	9.997480	9.033609	10.966391	50
11	9.032257	9.997466	9.034791	10.965209	49
12	9.033421	9.997452	9.035969	10.964031	48
13	9.034582	9.997439	9.036144	10.962856	47
14	9.035741	9.997425	9.038316	10.961684	46
15	9.036896	9.997411	9.039485	10.960515	45
16	9.038048	9.997397	9.040651	10.959349	44
17	9.039197	9.997383	9.041813	10.958187	43
18	9.040342	9.997369	9.042973	10.957027	42
19	9.041485	9.997355	9.044130	10.955870	41
20	9.042625	9.997341	9.045284	10.954716	40
21	9.043762	9.997327	9.046434	10.953566	39
22	9.044895	9.997313	9.047582	10.952418	38
23	9.046026	9.997299	9.048727	10.951273	37
24	9.047154	9.997285	9.049869	10.950131	36
25	9.049279	9.997271	9.051008	10.948992	35
26	9.049400	9.997256	4.052144	10.947856	34
27	9.050519	9.997242	9.043277	10.946723	33
28	9.051635	9.997228	9.054408	10.945592	32
29	9.052749	9.997214	9.055535	10.944465	31
30	9.053859	9.997199	9.056640	10.943340	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 83.

Degree 6.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.053859	9.997199	9.056640	10.943340	30
31	9.054966	9.997185	9.057781	10.942219	29
32	9.056071	9.997170	9.058900	10.941100	28
33	9.057172	9.997156	9.060016	10.939984	27
34	9.058271	9.997141	9.061130	10.938870	26
35	9.059367	9.997127	9.062240	10.937760	25
36	9.060460	9.997112	9.063348	10.936652	24
37	9.061551	9.997098	9.064453	10.935547	23
38	9.062638	9.997083	9.065556	10.934444	22
39	9.063723	9.997068	9.066655	10.933345	21
40	9.064806	9.997053	9.067752	10.932248	20
41	9.065885	9.997039	9.068847	10.931153	19
42	9.066962	9.997024	9.069938	10.930062	18
43	9.063036	9.997009	9.071027	10.928973	17
44	9.069107	9.996994	9.072113	10.927887	16
45	9.070176	9.996979	9.073197	10.926803	15
46	9.071242	9.996964	9.074278	10.925722	14
47	9.072306	9.996949	9.075356	10.924644	13
48	9.073366	9.996934	9.076432	10.923568	12
49	9.074424	9.996919	9.077505	10.922495	11
50	9.075480	9.996904	9.078576	10.921424	10
51	9.076533	9.996889	9.079644	10.920356	9
52	9.077583	9.996874	9.080710	10.919290	8
53	9.078631	9.996858	9.081773	10.918227	7
54	9.079676	9.996843	9.082833	10.917167	6
55	9.080719	9.996828	9.083891	10.916109	5
56	9.081759	9.996812	9.084947	10.915053	4
57	9.082797	9.996797	9.085999	10.914100	3
58	9.083832	9.996782	9.087050	10.912950	2
59	9.084864	9.996766	9.088098	10.911902	1
60	9.085894	9.996751	9.089144	10.910856	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 83.

Degree 7.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.085894	9.996751	9.089144	10.910856	60
1	9.086922	9.996735	9.090187	10.909813	59
2	9.087947	9.996720	9.091228	10.908772	58
3	9.088970	9.996704	9.092266	10.907734	57
4	9.089990	9.996688	9.093302	10.906698	56
5	9.091088	9.996673	9.094336	10.905664	55
6	9.092024	9.996657	9.095367	10.904633	54
7	9.093037	9.996641	9.096395	10.903604	53
8	9.094047	9.996625	9.097422	10.902578	52
9	9.095056	9.996610	9.098446	10.901554	51
10	9.096062	9.996594	9.099468	10.900532	50
11	9.097065	9.996578	9.100487	10.899513	49
12	9.098066	9.996562	9.101504	10.898496	48
13	9.099065	9.996546	9.102519	10.897481	47
14	9.100062	9.996530	9.103532	10.896468	46
15	9.101056	9.996514	9.104542	10.895458	45
16	9.102048	9.996498	9.105550	10.894450	44
17	9.103037	9.996482	9.106556	10.893444	43
18	9.104025	9.996465	9.107559	10.892441	42
19	9.105010	9.996449	9.108560	10.891440	41
20	9.105992	9.996433	9.109559	10.890441	40
21	9.106973	9.996417	9.110556	10.889444	39
22	9.107951	9.996400	9.111551	10.888449	38
23	9.108927	9.996384	9.112543	10.887457	37
24	9.109901	9.996368	9.113533	10.886467	36
25	9.110873	9.996351	9.114521	10.885478	35
26	9.111842	9.996335	9.115507	10.884493	34
27	9.112809	9.996318	9.116491	10.883509	33
28	9.113774	9.996302	9.117472	10.882528	32
29	9.114737	9.996285	9.118452	10.881548	31
30	9.115698	9.996269	9.119429	10.880571	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 82.

Degree 7.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.115698	9.996269	9.119429	10.880571	30
31	9.116656	9.996252	9.120404	10.879596	29
32	9.117612	9.996235	9.121377	10.878623	28
33	9.118567	9.996218	9.122348	10.877652	27
34	9.119519	9.996202	9.123317	10.876683	26
35	9.120469	9.996185	9.124284	10.875716	25
36	9.121417	9.996168	9.125248	10.874751	24
37	9.122362	9.996151	9.126211	10.873789	23
38	9.123306	9.996134	9.127172	10.872828	22
39	9.124248	9.996117	9.128130	10.871870	21
40	9.125187	9.996100	9.129087	10.870913	20
41	9.126125	9.996083	9.130041	10.869959	19
42	9.127060	9.996066	9.130994	10.869006	18
43	9.127993	9.996049	9.131944	10.868056	17
44	9.128925	9.996032	9.132893	10.867107	16
45	9.129854	9.996015	9.133839	10.869161	15
46	9.130781	9.995998	9.134784	10.865216	14
47	9.131706	9.995980	9.135726	10.864274	13
48	9.132630	9.995963	9.136666	10.863334	12
49	9.133551	9.995946	9.137605	10.862395	11
50	9.134470	9.995928	9.138542	10.861458	10
51	9.135387	9.995911	9.139476	10.860524	9
52	9.136303	9.995894	9.140409	10.859591	8
53	9.137216	9.995876	9.141340	10.858660	7
54	9.138127	9.995859	9.142269	10.857731	6
55	9.139037	9.995841	9.143196	10.856804	5
56	9.139944	9.995825	9.144121	10.855879	4
57	9.140850	9.995806	9.145044	10.854956	3
58	9.141754	9.995788	9.145965	10.854035	2
59	9.142655	9.995770	9.146885	10.853115	1
60	9.142555	9.995753	9.147803	10.852197	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 82.

Degree 8.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.143555	9.995753	9.147803	10.852197	60
1	9.144453	9.995735	9.148718	10.851282	59
2	9.145349	9.995717	9.149632	10.850368	58
3	9.146243	9.995699	9.159544	10.849456	57
4	9.147136	9.995681	9.151454	10.848546	56
5	9.148026	9.995664	9.152363	10.847637	55
6	9.148915	9.995646	9.153269	10.846731	54
7	9.149801	9.995628	9.154174	10.845825	53
8	9.150686	9.995610	9.155077	10.844923	52
9	9.151569	9.995591	9.155978	10.844022	51
10	9.152451	9.995573	9.156877	10.843123	50
11	9.153330	9.995555	9.157775	10.842225	49
12	9.154208	9.995537	9.158671	10.841329	48
13	9.155082	9.995519	9.159565	10.840435	47
14	9.155957	9.995501	9.160457	10.839543	46
15	9.156830	9.995482	9.161347	10.838653	45
16	9.157700	9.995464	9.162236	10.837764	44
17	9.158569	9.995446	9.163123	10.836877	43
18	9.159436	9.995427	9.164008	10.835992	42
19	4.160301	9.995409	9.164892	10.835108	41
20	9.161164	9.995390	9.165773	10.834226	40
21	9.162025	9.995372	9.166654	10.833346	39
22	9.162885	9.995353	9.167532	10.832468	38
23	9.163743	9.995334	9.168409	10.831591	37
24	9.164600	9.995316	9.169284	10.830716	36
25	9.165454	9.995297	9.160157	10.829843	35
26	9.166307	9.995278	9.171029	10.828971	34
27	9.167158	9.995260	9.171899	10.828101	33
28	9.168008	9.995241	9.172767	10.827233	32
29	9.168856	9.995222	9.173634	10.826366	31
30	9.169702	9.995203	9.174499	10.825501	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 81.

Degree 8.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.169702	9.995203	9.174499	10.825501	30
31	9.170546	9.995184	9.175362	10.824638	29
32	9.171389	9.995165	9.176224	10.823776	28
33	9.172230	9.995146	9.177084	10.822916	27
34	9.173070	9.995127	9.177943	10.822057	26
35	9.173908	9.995108	9.178799	10.821201	25
36	9.174744	9.995089	9.179655	10.820345	24
37	9.175578	9.995070	9.180508	10.819492	23
38	9.176411	9.995061	9.181360	10.818640	22
39	9.177242	9.995032	9.182211	10.817789	21
40	9.178072	9.995012	9.183060	10.816940	20
41	9.178900	9.994993	9.183907	10.816093	19
42	9.179726	4.994974	9.184752	19.815248	18
43	9.180551	9.994955	9.185597	10.814403	17
44	9.181374	9.944935	9.186439	10.813561	16
45	9.182196	9.994916	9.187280	10.812720	15
46	9.183016	9.994896	9.188120	10.811880	14
47	9.183834	9.994876	9.188957	10.811042	13
48	9.184651	9.994857	9.189794	10.810206	12
49	9.185466	9.994838	9.190629	10.809371	11
50	9.186280	9.994818	9.191462	10.808538	10
51	9.187092	9.994798	9.192294	10.807706	9
52	9.187903	9.994779	9.193124	10.806876	8
53	9.188712	9.994759	9.193953	10.806047	7
54	9.189519	9.994739	9.194780	10.805220	6
55	9.190325	9.994719	9 195606	10.804394	5
56	9.191130	9.994699	9.196440	10.803569	4
57	9.191933	9.994680	9.197253	10.802747	3
58	9.192734	9.994660	9.198674	10.801926	2
59	9.193534	9.994640	9.198894	10.801106	1
60	9.194332	9.994620	9.199712	10.800287	0
	Co sine	Sine	Co-tang.	Tangent	M

Degree 81.

Degree 9

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.194332	9.994620	9.199712	10.800287	60
1	9.195129	9.994600	9.200529	10.799470	59
2	9.195925	9.994580	9.201345	10.798655	58
3	9.196718	9.994560	9.202159	10.797841	57
4	9.197511	9.994540	9.202971	10.797029	56
5	9.198302	9.994519	9.203782	10.796218	55
6	9.199091	9.994499	9.204592	10.795408	54
7	9.199879	9.994479	9.205400	10.794600	53
8	9.200666	9.994459	9.206207	10.793793	52
9	9 201451	9.994438	9.207013	10.792987	51
10	9.202234	9.994418	9.207817	10.792183	50
11	9.203017	9.994398	9.208619	10.791381	49
12	9.203797	9.994377	9.209420	10.790580	48
13	9.204577	9 994357	9.210220	10.789780	47
14	9.205354	9.994336	9.211018	10.788982	46
15	9.206131	9.994316	9.211815	10.788185	45
16	9.206906	9.994195	9.212611	10.787385	44
17	9.207679	9.994174	9.213405	10.786595	43
18	9.208452	9.994154	9.214198	10.785802	42
19	9.209222	9.994133	9.214989	10.785011	41
20	9.209992	9.994112	9.215780	10.784220	40
21	9.210760	9.994191	9.216568	10.783432	39
22	9 211526	9.994171	9.217356	10.782644	38
23	9.212291	9.994150	9.218142	10.781858	37
24	9.213055	9.994129	9.218926	10.781070	36
25	9.213818	9.994108	9.219710	10.780294	35
26	9.214579	9.994087	9.220491	10.779508	34
27	9.215338	9.994066	9.221272	10.778728	33
28	9.216097	9.994044	9.222052	10.777948	32
29	9.216854	9.994024	9.222830	10.777170	31
30	9.217609	9.994003	9.223607	10.776393	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 80.

Degree 9

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.217609	9.994003	9.223607	10.716393	30
31	9.218363	9.993982	9.224382	10.775618	29
32	9.219116	9.993960	9.225156	10.774844	28
33	9.219868	9.993939	9.225929	10.774071	27
34	9.220618	9.993918	9.226704	10.773300	26
35	9.221367	9.993897	9.227471	10.772529	25
36	9.222115	9.993875	9.228240	10.771760	24
37	9.222861	9.993854	9.229007	10.770993	23
38	9.223606	9.993832	9.229774	10.770226	22
39	9.224349	9.993811	9.230539	10.769461	21
40	9.225092	9.993789	9.231302	10.768698	20
41	9.225833	9.993768	9.232065	10.767935	19
42	9.226573	9.993746	9.232826	10.767174	18
43	9.227311	9.993725	9.233586	10.766414	17
44	9.228048	9.993703	9.234345	10.765655	16
45	9.228784	9.993681	9.235103	10.764897	15
46	9.239518	9.993660	9.235859	10.764141	14
47	9.230252	9.993638	9.236614	10.763386	13
48	9.230984	9.993616	9.237368	10.762632	12
49	9.231715	9.993594	9.238120	10.761880	11
50	9.232444	9.993572	9.238872	16.761128	10
51	9.233172	9.993550	9.239622	10.760378	9
52	9.233899	9.993528	9.240371	10.759629	8
53	9.234625	9.993506	9.241118	10.758882	7
54	9.235349	9.993484	9.241865	10.758135	6
55	9.236073	9.993462	9.242610	10.757390	5
56	9.236795	9.993440	9.243354	10.756646	4
57	9.237515	9.993418	9.244097	10.755903	3
58	9.238835	9.993396	9.244839	10.755161	2
59	9.238952	9.993374	9.245579	10.754421	1
60	9.239670	9.993351	9.246319	10.753681	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 80.

Degree 10.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.239670	9.993351	9.246319	10.753681	60
1	9.240386	9.993329	9.247057	10.752943	59
2	9.241101	9.993307	9.247794	10.752206	58
3	9.241814	9.993284	9.248530	10.751470	57
4	9.242526	9.993262	9.249264	10.750736	56
5	9.243237	9.993240	9.249998	10.750002	55
6	9.243947	9.993117	9.250730	10.749270	54
7	9.244656	9.993195	9.251461	10.748539	53
8	9.245363	9.993172	9.252191	10.747809	52
9	9.246070	9.993149	9.252920	10.747080	51
10	9.246775	9.993127	9.253648	10.746352	50
11	9.247478	9.993104	9.254374	10.745626	49
12	9.248181	9.993011	9.255200	10.744900	48
13	9.248883	9.993059	9.255824	10.744176	47
14	9.249583	9.993036	9.256547	10.743453	46
15	9.250282	9.993013	9.257269	10.742731	45
16	9.250980	9.992990	9.257990	10.742010	44
17	9.251677	9.992967	9.258710	10.741290	43
18	9.252373	9.992944	9.259429	10.740571	42
19	9.253067	9.992921	9.260146	10.739854	41
20	9.253761	9.992898	9.260863	10.739137	40
21	9.254453	9.992875	9.261578	10.738422	39
22	9.255144	9.992852	9.262292	10.737708	38
23	9.255834	9.992829	9.263005	10.736995	37
24	9.256523	9.992806	9.263717	10.736283	36
25	9.257211	9.992783	9.264428	10.735572	35
26	9.257898	9.992759	9.265138	10.734862	34
27	9.258583	9.992736	9.265847	10.734153	33
28	9.259268	9.992713	9.266555	10.733445	32
29	9.259951	9.992690	9.267261	10.732739	31
30	9.260633	9.992666	9.267967	10.732033	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 79.

Degree 10.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.260633	9.992666	9.267967	10.732033	30
31	9.261314	9.992643	9.268671	10.731329	29
32	9.261994	9.992619	9.269375	10.730625	28
33	9.262673	9.992596	9.270778	10.729923	27
34	9.263351	9.992572	9.271479	10.729221	26
35	9.264027	9.992549	9.271479	10.728521	25
36	9.264703	9.992525	9.272178	10.727822	24
37	9.265378	9.992501	9.272876	10.727124	23
38	9.266051	9.992478	9.273573	10.726427	22
39	9.266723	9.992454	9.274269	10.725731	21
40	9.267395	9.992430	9.274964	10.725036	20
41	9.268065	9.992406	9.275658	10.724342	19
42	9.268734	9.992382	9.276351	10.723649	18
43	9.269402	9.992362	9.277043	10.722957	17
44	9.270069	9.992335	9.277734	10.722267	16
45	9.270735	9.992311	9.278424	10.721576	15
46	9.271400	9.992287	9.279113	10.720887	14
47	9.272063	9.992263	9.279801	10.720199	13
48	9.272726	9.992239	9.280488	10.719512	12
49	9.273388	9.992214	9.281174	10.718826	11
50	9.274049	9.992190	9.281858	10.718142	10
51	9.274708	9.992166	9.282542	10.717458	9
52	9.275367	9.992142	9.283225	10.716775	8
53	9.276025	9.992118	9.283907	10.716093	7
54	9.276681	9.992093	9.284588	10.715412	6
55	9.277337	9.992069	9.285268	10.714732	5
56	9.277991	9.992045	9.285946	10.714053	4
57	9.278685	9.992020	9.286624	10.713376	3
58	9.279297	9.991996	9.287301	10.712695	2
59	9.279948	9.991971	9.287977	10.712023	1
60	9.280599	9.991947	9.288652	10.711348	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 79.

Degree 11.

M	Sine	Co sine	Tangen.	Co-tang.	
0	9.280599	9.991947	9.288652	10.711348	60
1	9.281229	9.991922	9.289326	10.710674	59
2	9.281897	9.991897	9.289999	10.710001	58
3	9.282544	9.991873	9.290671	10.709329	57
4	9.283190	9.991848	9.291342	10.708658	56
5	9.283836	9.991823	9.292013	10.707987	55
6	9.284480	9.991799	9.292682	10.707318	54
7	9.285124	9.991774	9.293350	10.706650	53
8	9.285766	9.991749	9.294017	10.705983	52
9	9.286408	9.991724	9.294684	10.705316	51
10	9.287048	9.991699	9.295349	10.704651	50
11	9.287688	9.991674	9.296013	10.703987	49
12	9.288326	9.991649	9.296677	10.703323	48
13	9.288964	9.991624	9.297339	10.702661	47
14	9.289600	9.991599	9.298001	10.701999	46
15	9.290236	9.991574	9.298662	10.701338	45
16	9.290870	9.991549	9.299322	10.700678	44
17	9.291504	9.991524	9.299980	10.700020	43
18	9.292137	9.991498	9.300638	10.699362	42
19	9.292768	9.991473	9.301295	10.698705	41
20	9.293399	9.991448	9.301951	10.698049	40
21	9.294029	9.991422	9.302607	10.697393	39
22	9.294658	9.991397	9.303261	10.696739	38
23	9.295286	9.991372	9.303914	10.696086	37
24	9.295913	9.991346	9.304567	10.695433	36
25	9.296539	9.991321	9.305218	10.694782	35
26	9.297164	9.991295	9.305867	10.694131	34
27	9.297788	9.991270	9.306519	10.693481	33
28	9.298412	9.991244	9.307168	10.692832	32
29	9.299034	9.991218	9.307816	10.692184	31
30	9.299655	9.991193	9.308463	10.691537	30
	Co-sine	Sine	Co tang.	Tangent	M

Degree 78.

Degree 11.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.299655	9.991193	9.308463	10.691537	30
31	9.300276	9.991167	9.309109	10.690891	29
32	9.300895	9.991141	9.309754	10.690246	28
33	9.301514	9.991115	9.310399	10.689601	27
34	9.302132	9.991090	9.311042	10.688958	26
35	9.302749	9.991064	9.311685	10.688315	25
36	9.303364	9.991038	9.312327	10.687673	24
37	9.303979	9.991012	9.312968	10.687032	23
38	9.304593	9.990986	9.313608	10.686392	22
39	9.305207	9.990960	9.314247	10.685753	21
40	9.305819	9.990934	9.314885	10.685115	20
41	9.306430	9.990908	9.315523	10.684477	19
42	9.307041	9.990882	9.316159	10.683841	18
43	9.307650	9.990855	9.316795	10.683205	17
44	9.308259	9.990829	9.317430	10.682570	16
45	9.308867	9.990803	9.318064	10.681936	15
46	9.309474	9.990777	9.318647	10.681303	14
47	9.310080	9.990750	9.319330	10.680670	13
48	9.310685	9.990724	9.319961	10.680039	12
49	9.311289	9.990697	9.320592	10.679408	11
50	9.311899	9 990671	9.321222	10.678778	10
51	9.312495	9.990645	9.321851	10.678149	9
52	9.313097	9.990618	9.322479	10.677521	8
53	9.313698	9.990591	9.323106	10.676894	7
54	9.314297	9.990565	9.323733	10.676267	6
55	9.314897	9.990538	9.324358	10 675642	5
57	9.315495	9.990512	9.324983	10.675017	4
57	9.316092	9.990485	9.325607	10.674393	3
58	9.316689	9.990458	9.326231	10.673769	2
59	9.317284	9.990431	9.326853	10.673147	1
60	9.317879	9.990404	9.327475	10.672525	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 78.

Degree 12.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.317879	9.990404	9.327475	10.672525	60
1	9.318473	9.990377	9.328095	10.671905	59
2	9.319066	9.990351	9.328715	10.671285	58
3	9.319658	9.990324	9.329334	10.670666	57
4	9.320250	9.990297	9.329953	10.670047	56
5	9.320840	9.990270	9.320570	10.669430	55
6	9.321430	9.990242	9.331187	10.668813	54
7	9.322019	9.990215	9.331803	10.668197	53
8	9.322607	9.990188	9.332418	10.667582	52
9	9.323194	9.990161	9.333033	10.666967	51
10	9.323780	9.990134	9.333646	10.666354	50
11	9.324366	9.990107	9.334259	10.665741	49
12	9.324950	9.990079	9.334871	10.665129	48
13	9.325534	9.990052	9.335482	10.664518	47
14	9.326117	9.990025	9.336093	10.663907	46
15	9.326699	9.989997	9.33670[illegible]	10.663298	45
16	9.327281	9.989970	9.337311	10.662689	44
17	9.327862	9.989942	9.337919	10.662081	43
18	9.328441	9.989915	9.338527	10.661473	42
19	9.329020	9.989887	9.339133	10.660867	41
20	9.329599	9.989860	9.339739	10.660261	40
21	9.330176	9.989832	9.340344	10.659656	39
22	9.330753	9.989804	9.340948	10.659052	38
23	9.331328	9.989777	9.341552	10.658448	37
24	9.331903	9.989749	9.342155	10.657845	36
25	9.332478	9.989721	9.342757	10.657243	35
26	9.333051	9.989693	9.343358	10.656642	34
27	9.333624	9.989665	9.343958	10.656042	33
28	9.334195	9.989637	9.344558	10.655442	32
29	9.334766	9.989609	9.345157	10.654843	31
30	9.335337	9.989581	9.345755	10.654245	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 77.

Degree 12.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.335337	9.989581	9.345755	10.654245	30
31	9.335906	9.989553	9.346353	10.653647	29
32	9.336475	9.989525	9.346949	10.653051	28
33	9.337043	9.989597	9.347545	10.652455	27
34	9.337610	9.989469	9.348141	10.651859	26
35	9.338176	9.989441	9.348735	10.651265	25
36	9.338742	9.989413	9.349329	10.650671	24
37	9.339306	9.989384	9.349922	10.650078	23
38	9.339870	9.989356	9.350514	10.649486	22
39	9.340434	9.989328	9.351106	10.648894	21
40	9.340996	9.989299	9.351697	10.648303	20
41	9.341558	9.989271	9.352287	10.647713	19
42	9.342119	9.989243	9.352876	10.647124	18
43	9.342679	9.989214	9.353465	10.646535	17
44	9.343239	9.989186	9.354053	10.645947	16
45	9.343797	9.989157	9.354640	10.645360	15
46	9.344355	9.989128	9.355227	10.644773	14
47	9.344912	9.989100	9.355812	10.644187	13
48	9.345469	9.989071	9.356398	10.643602	12
49	9.346024	9.989042	9.356982	10.643018	11
50	9.346579	9.989014	9.357566	10.642434	10
51	9.347134	9.988985	9.358149	10.641851	9
52	9.347687	9.988956	9.358731	10.641269	8
53	9.348240	9.988927	9.359313	10.640687	7
54	9.348792	9.988898	9.359893	10.640107	6
55	9.349343	9.988869	9.360474	10.639526	5
56	9.349893	9.988840	9.361053	10.638947	4
57	9.350443	9.988811	9.361632	10.638368	3
58	9.350992	9.988782	9.362210	10.637790	2
59	9.351540	9.988754	9.362787	10.637213	1
60	9.352088	9.988724	9.363364	10.636636	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 77.

Degree 13.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.352083	9.988724	9.363364	10.636636	60
1	9.352635	9.988695	9.363940	10.636060	59
2	9.353181	9.988666	9.364515	10.635485	58
3	9.353726	9.988636	9.365090	10.634910	57
4	9.354271	9.988607	9.365664	10.634336	56
5	9.354185	9.988578	9.366237	10.633763	55
6	9.355358	9.988548	9.366810	10.633190	54
7	9.355901	9.988519	9.367382	10.632618	53
8	9.356443	9.988489	9.367953	10.632047	52
9	9.356984	9.988460	9.368524	10.631476	51
10	9.357524	9.988430	9.369094	10.630906	50
11	9.358064	9.988401	9.369663	10.630337	49
12	9.358603	9.988371	9.370232	10.629768	48
13	9.359141	9.988341	9.370799	10.629201	47
14	9.359679	9.988312	9.371367	10.628633	46
15	9.350215	9.988282	9.371933	10.628067	45
16	9.360752	9.988252	9.372499	10.627501	44
17	9.361287	9.988223	9.373064	10.626936	43
18	9.361822	9.988193	9.373629	10.626371	42
19	9.362356	9.988163	9.374193	10.625807	41
20	9.362889	9.988133	9.374756	10.625244	40
21	9.363422	9.988103	9.375319	10.624681	39
22	9.363954	9.988073	9.375881	10.624119	38
23	9.364485	9.988043	9.376442	10.623558	37
24	9.365016	9.988013	9.377003	10.622997	36
25	9.365546	9.987983	9.377563	10.622437	35
26	9.366075	9.987953	9.378122	10.621878	34
27	9.366604	9.987922	9.378681	10.621319	33
28	9.367132	9.987892	9.379239	10.620761	32
29	9.367659	9.987862	9.379797	10.620203	31
30	9.368185	9.987832	9.380354	10.619646	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 76.

Degree 13.

M	Sine	*Co-sine*	Tangent	*Co-tang*	
30	9.368185	9.987832	9.380354	10.619646	30
31	9.368711	9.987801	9.380910	10.619090	29
32	9.369236	9.987771	9.381466	10.618534	28
33	9.369761	9.987740	9.382021	10.617980	27
34	9.370285	9.987710	9.382575	10.617425	26
35	9.370808	9.987679	9.383129	10.616871	25
36	9.371330	9.987649	9.383682	10.616318	24
37	9.371852	9.987618	9.384234	10.615766	23
38	9.372373	9.987588	9.384786	10.615214	22
39	9.372894	9.987557	9.385337	10.614663	21
40	9.373414	9.987526	9.385888	10.614112	20
41	9.373933	9.987496	9.386438	10.613562	19
42	9.374452	9.987465	9.386987	10.613013	18
43	9.374970	9.987434	9.387536	10.612464	17
44	9.375487	9.987403	9.388084	10.611916	16
45	9.376003	9.987372	9.388631	10.611369	15
46	9.376519	9.987341	9.389178	10.610822	14
47	9.377035	9.987310	9.389724	10.610276	13
48	9.377549	9.987279	9.390270	10.609730	12
49	9.378063	9.987248	9.390815	10.609185	11
50	9.378577	9.987217	9.391360	10.608640	10
51	9.379089	9.987186	9.391907	10.608097	9
52	9.379601	9.987155	9.392467	10.607553	8
53	9.380113	9.987124	9.392989	10.607011	7
54	9.380624	9.987092	9.393531	10.606469	6
55	9.381134	9.987061	9.394074	10.605927	5
56	9.381643	9.987030	9.394614	10.605386	4
57	9.382152	9.986998	9.395154	10.604846	3
58	9.382661	9.986967	9.395694	10.604306	2
59	9.383168	9.986936	9.396233	10.603767	1
60	9.383675	9.986904	9.39677	10.603229	0
	Co sine	Sine	*Co-tang.*	Tangent	M

Degree 76.

Degree 14.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.383675	9.986904	9.396771	10.603229	60
1	9.384181	9.986873	9.397309	10.602694	59
2	9.384687	9.986841	9.397846	10.602154	58
3	9.385192	9.986809	9.398383	10.601617	57
4	9.385697	9.986778	9.398919	10.601081	56
5	9.386201	9.986746	9.399455	10.600545	55
6	9.386704	9.986714	9.399990	10.600010	54
7	9.387207	9.986683	9.400524	10.599476	53
8	9.387709	9.986651	9.401058	10.598942	52
9	9.388210	9.986619	9.401591	10.598409	51
10	9.388711	9.986587	9.402124	10.597876	50
11	9.389211	9.986555	9.402656	10.597344	49
12	9.389711	9.986523	9.403187	10.596813	48
13	9.390210	9.986491	9.403718	10.596282	47
14	9.390708	9.986459	9.404249	10.595751	46
15	9.391206	9.986427	9.404778	10.595222	45
16	9.391703	9.986395	9.405306	10.594692	44
17	9.392199	9.986363	9.405836	10.594164	43
18	9.392695	9.986331	9.406364	10.593636	42
19	9.393190	9.986299	9.406892	10.593608	41
20	9.393685	9.986266	9.407419	10.592581	40
21	9.394179	9.986234	9.407945	10.592055	39
22	9.394673	9.986201	9.408471	10.591529	38
23	9.395166	9.986869	9.408996	10.591001	37
24	9.395654	9.986137	9.409521	10.590479	36
25	9.396150	9.986104	9.410045	10.589954	35
26	9.396641	9.986072	9.410569	10.589431	34
27	9.397131	9.986039	9.411097	10.588908	33
28	9.397621	9.986007	9.411615	10.588385	32
29	9.398111	9.985974	9.412137	10.587863	31
30	9.398600	9.986942	9.412658	10.587342	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 75.

Degree 14.

M	Sine	*Co-sine*	Tangent	*Co-tang*	
30	9.398600	9.985942	9.412658	10.587342	30
31	9.399087	9.985909	9.413179	10.586821	29
32	9.399575	9.985876	9.413699	10.586301	28
33	9.400062	9.985843	9.414219	10.585781	27
34	9.400549	9.985811	9.414738	10.585262	26
35	9.401035	9.985778	9.415257	10.584742	25
36	9.401520	9.985745	9.415775	10.584225	24
37	9.402005	9.985712	9.416293	10.583707	23
38	9.402489	9.985679	9.416810	10.583190	22
39	9.402972	9.985646	9.417326	10.582674	21
40	9.403455	9.985613	9.417842	10.582157	20
41	9.403938	9.985580	9.418357	10.581642	19
42	9.404420	4.985547	9.418873	10.581127	18
43	9.404901	9 985513	9.419387	10.580613	17
44	9.405382	9.985480	9.419901	10.580099	16
45	9.405862	9.985447	9.420415	10.579585	15
46	9.406341	9.985414	9.420927	10.579072	14
47	9.406820	9.985380	9.421440	10.578560	13
48	9.407299	9.985347	9.421951	10.578048	12
49	9.407776	9.985314	9.422463	10.577537	11
50	9.408254	9.985280	9.422973	10.577026	10
51	9.408731	9.985247	9.423484	10.576516	9
52	9.409207	9.985213	9.423993	10.576007	8
53	9.409682	9.985180	9.424503	10.575497	7
54	9.410157	9.985146	9.425011	10.574989	6
55	9.410632	9.985112	9 425518	10.574480	5
56	9.411106	9.985079	9.426027	10.573973	4
57	9.411579	9.985045	9.426534	10.573466	3
58	9.412052	9.985011	9.427041	10.572959	2
59	9.412524	9.984977	9.427547	10.572453	1
60	9.412996	9.984943	9.428052	10.571947	0
	Co sine	Sine	*Co-tang.*	Tangent	M

Degree 75.

Degree 15.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.412996	9.984944	9.428052	10.571947	60
1	9.413467	9.984910	9.428557	10.571442	59
2	9.413938	9.984876	9.429067	10.570938	58
3	9.414408	9.984842	9.429566	10.570434	57
4	9.414878	9.984808	9.430070	10.569930	56
5	9.415347	9.984774	9.430573	10.569427	55
6	9.415815	9.984740	9.431075	10.568925	54
7	9.416283	9.984706	9.431577	10.568423	53
8	9.416850	9.984672	9.432079	10.567921	52
9	9.417217	9.984637	9.432580	10.567420	51
10	9.417684	9.984603	9.433080	10.566920	50
11	9.418149	9.984569	9.433580	10.566419	49
12	9.418615	9.984535	9.434080	10.565920	48
13	9.419079	9 984500	9.434579	10.565421	47
14	9.419544	9.984466	9.435078	10.564922	46
15	9.420007	9.984431	9.435576	10.564424	45
16	9.420470	9.984397	9.436073	10.563927	44
17	9.420933	9.984363	9.436570	10.563430	43
18	9.421395	9.984328	9.437067	10.562933	42
19	9.421856	9.984293	9.437563	10.562437	41
20	9.422317	9.984259	9.438059	10.561941	40
21	9.422778	9.984224	9.438554	10.561446	39
22	9 423238	9.984189	9.439548	10.560952	38
23	9.423697	9.984155	9.439543	10.560457	37
24	9.424156	9.984120	9.440036	10.559964	36
25	9.424615	9.984085	9.440529	10.559471	35
26	9.425072	9.984050	9.441022	10.558978	34
27	9.425530	9.984015	9.441514	10.558486	33
28	9.425987	9.983980	9.442006	10.557994	32
29	9.426443	9.983945	9 442497	10.557503	31
30	9.426899	9.983910	9.442988	10.557011	30
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 74.

Degree 15

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.426899	9.983910	9.442988	10.557011	30
31	9.427354	9.983875	9.443479	10.556521	29
32	9.427809	9.983840	9.443968	10.556031	28
33	9.428264	9.983805	9.444458	10.555542	27
34	9.428717	9.983770	9.444947	10.555053	26
35	9.429170	9.983735	9.445435	10.554565	25
36	9.429623	9.983699	9.445923	10.554077	24
37	9.430075	9.983664	9.446411	10.553589	23
38	9.430507	9.983629	9.446898	10.553102	22
39	9.430978	9.983593	9.447384	10.552616	21
40	9.431429	9.983558	9.447870	10.552129	20
41	9.431879	9.983523	9.448356	10.551644	19
42	9.432328	9.983187	9.448841	10.551159	18
43	9.432778	9.983452	9.449326	1o.550674	17
44	9.433206	9.983416	9.449810	10.550181	16
45	9.433674	9.983380	9.450294	10.559706	15
46	9.434122	9.983345	9.450777	10.549223	14
47	9.434569	9.983309	9.451260	10.548740	13
48	9.435016	9.983273	9.451743	10.548257	12
49	9.435462	9.983238	9.452225	10.547775	11
50	9.435918	9.983202	9.452706	16.547294	10
51	9.436353	9.983166	9.453187	10.546813	9
52	9.436798	9.983130	9.453668	10.546332	8
53	9.437242	9.983094	9.454148	10.545852	7
54	9.437686	9.983058	9.454629	10.545372	6
55	9.438129	9.983022	9.455107	10.544893	5
56	9.438572	9.982986	9.455586	10.544414	4
57	9.439014	9.982950	9.456064	10.543936	3
58	9.439456	9.982914	9.456542	10.543458	2
59	9.439897	9.982878	9.457019	10.542980	1
60	9.440338	9.982842	9.457496	10.542503	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 74.

Degree 16.

M	Sine	*Co-ſine*	Tangent	*Co-tang.*	
0	9.440338	9.982842	9.457496	10.542503	60
1	9.440778	9.982805	9.457973	10.542027	59
2	9.441218	9.982769	9.458449	10.541551	58
3	9.441658	9.982733	9.458925	10.541075	57
4	9.442096	9.982696	9.459400	10.540600	56
5	9.442535	9.982660	9.459875	10.540125	55
6	9.442973	9.982623	9.460349	10.539651	54
7	9.443416	9.982587	9.460829	10.539177	53
8	9.443848	9.982550	9.461297	10.538703	52
9	9.444284	9.982514	9.461770	10.538230	51
10	9.444720	9.982477	9.462242	10.537758	50
11	9.445155	9.982441	9.462714	10.537285	49
12	9.445590	9.982404	9.463186	10.536814	48
13	9.446025	9.982367	9.463658	10.536342	47
14	9.446459	9.982330	9.46 129	10.535871	46
15	9.446893	9.982294	9.464599	10.535 01	45
16	9.447326	9.982257	9.465069	10.534931	44
17	9.447759	9.982220	9.465539	10.534461	43
18	9.448191	9.982183	9.466008	10.533992	42
19	9.448623	9.982146	9.466476	10.533523	41
20	9.449054	9.982109	9.466945	10.533055	40
21	9.449485	9.982072	9.467413	10.53[illegible]587	39
22	9.449915	9.982035	9.467880	10.532120	38
23	9.450345	9.981998	9.468347	10.531653	37
24	9.450775	9.981961	9.468814	10.531186	36
25	9.451203	9.981923	9.469280	10.530720	35
26	9.451632	9.981886	9.469746	10.530254	34
27	9.452060	9.981849	9.470211	10.529789	33
28	9.452488	9.981812	9.470676	10.529324	32
29	9.452915	9.981774	9.47114	10.528859	31
30	9.453342	9.981737	9.4716[illegible]5	10.528395	30
	Co-ſine	Sine	*Co-tang*	Tang	M

Degree 73.

Degree 16.

M	Sine	Co-sine	Tangen.	Co tang.	
30	9.453342	9.981737	9.471605	10.528395	30
31	9.453768	9.981699	9.472068	10.527931	29
32	9.454194	9.981662	9.472532	10.527468	28
33	9.454619	9.981624	9.472995	10.527005	27
34	9.455044	9.981587	9.473457	10.526543	26
35	9.455469	9.981549	9.473919	10.526081	25
36	9.455892	9.981512	9.474381	10.525619	24
37	9.456316	9.981474	9.474842	10.525158	23
38	9.456739	9.981436	9.475303	10.524695	22
39	9.457162	9.981398	9.475763	10.524237	21
40	9.457584	9.981361	9.476223	10.523777	20
41	9.458006	9.981323	9.476683	10.523317	19
42	9.458427	9.981285	9.477142	10.522858	18
43	9.458848	9.981247	9.477601	10.522399	17
44	9.459268	9.981209	9.478059	10.521941	16
45	9.459684	9.981171	9.478517	10.521483	15
46	9.460108	9.981133	9.478975	10.521025	14
47	9.460527	9.981095	9.479432	10.520 68	13
48	9.460946	9.981057	9.479886	10.520111	12
49	9.461364	9.981019	9.480345	10.519655	11
50	9.461782	9.980980	9.480801	10.519199	10
51	9.462199	9.980942	9.481257	10.518743	9
52	9.462616	9.980904	9.481712	10.518288	8
53	9.463032	9.980866	9.482167	10.517833	7
54	9.463448	9.980827	9.482621	10.517379	6
55	9.463864	9.980789	9.483075	10.516925	5
56	9.464279	9.980750	9.483528	10.516471	4
57	9.464694	9.980712	9.483982	10.516018	3
58	9.465108	9.980672	9.484434	10.515565	2
59	9.465522	9.980635	9.484887	10.515113	1
60	9.465935	9.980596	9.485339	10.514661	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 73.

Degree 17.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.465935	9.980596	9.485339	10.514661	60
1	9.466348	9.980558	9.485791	10.514209	59
2	9.466761	9.980519	9.486272	10.513758	58
3	9.467173	9.980480	9.486693	10.513307	57
4	9.467585	9.980441	9.487143	10.512857	56
5	9.467996	9.980403	9.487593	10.512407	55
6	9.468407	9.980364	9.488043	10.511957	54
7	9.468817	9.980325	9.488493	10.511507	53
8	9.469227	9.980286	9.488941	10.511059	52
9	9.469637	9.980247	9.489390	10.510610	51
10	9.460446	9.980208	9.489838	10.510162	50
11	9.470455	9.980169	9.490286	10.509714	49
12	9.471863	9.980130	9.490733	10.509267	48
13	9.471071	9.980091	9.491180	10.508820	47
14	9.471678	9.980052	9.491627	10.508373	46
15	9.472086	9.980012	9.492073	10.507928	45
16	9.472492	9.979973	9.492519	10.507481	44
17	9.472898	9.979934	9.492964	10.507035	43
18	9.473304	9.979894	9.493410	10.506590	42
19	9.473710	9.979855	9.493854	10.506145	41
20	9.474115	9.979816	9.494299	10.505701	40
21	9.474519	9.979776	9.494743	10.505257	39
22	9.474923	9.979737	9.495186	10.504813	38
23	9.475327	9.979697	9.495630	10.504370	37
24	9.475730	9.979658	9.496073	10.503928	36
25	9.476133	9.979618	9.496515	10.503485	35
26	9.476539	9.979578	9.496957	10.503043	34
27	9.476938	9.979539	9.497399	10.502601	33
28	9.477340	9.979499	9.497840	10.502160	32
29	9.477741	9.979459	9.498282	10.501718	31
30	9.478142	9.979419	9.498722	10.501278	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 72.

Degree 17.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.478142	9.979419	9.498722	10.501278	30
31	9.478542	9.979380	9.499163	10.500837	29
32	9.478942	9.979340	9.499602	10.500398	28
33	9.479342	9.979300	9.500042	10.499958	27
34	9.479741	9.979260	9.500481	10.499519	26
35	9.480140	9.979220	9.500920	10.499080	25
36	9.480538	9.979180	9.501359	10.498641	24
37	9.480936	9.979140	9.501797	10.498203	23
38	9.481334	9.979099	9.502234	10.497765	22
39	9.481731	9.979059	9.502672	10.497328	21
40	9.482128	9.979019	9.503109	10.496891	20
41	9.482525	9.978980	9.503546	10.496454	19
42	9.482921	9.978939	9.503982	10.496018	18
43	9.483316	9.978898	9.504418	10.495582	17
44	9.483711	9.978858	9.504854	10.495146	16
45	9.484106	9.978817	9.505289	10.494711	15
46	9.484501	9.978777	9.505724	10.494216	14
47	9.484895	9.978736	9.506158	10.493841	13
48	9.485289	9.978696	9.506593	10.493407	12
49	9.485682	9.978655	9.507026	10.492973	11
50	9.486075	9.978615	9.507459	10.492540	10
51	9.486467	9.978574	9.507892	10.492107	9
52	9.486859	9.978533	9.508326	10.491674	8
53	9.487251	9.978493	9.508759	10.491241	7
54	9.487642	9.978452	9.509181	10.490809	6
55	9.488033	9.978411	9.509622	10.490377	5
56	9.488424	9.978370	9.510044	10.489946	4
57	9.488814	9.978329	9.510486	10.489515	3
58	9.489204	9.978288	9.510916	10.489084	2
59	9.489593	9.978247	9.511346	10.488654	1
60	9.489982	9.978206	9.511776	10.488225	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 72.

Degree 18.

M	Sine	*Co sine*	Tangen.	*Co tang*	
0	9.489982	9.978206	9.511776	10.488224	60
1	9.490371	9.978165	9.512206	10.487794	59
2	9.490759	9.978124	9.512635	10.487365	58
3	9.491147	9.978083	9.513064	10.486936	57
4	9.491534	9.978042	9.513493	10.486507	56
5	9.491922	9.978000	9.513921	10.486079	55
6	9.492308	9.977959	9.514349	10.485651	54
7	9.492695	9.977918	9.514777	10.485223	53
8	9.493080	9.977877	9.515204	10.484796	52
9	9.493466	9.977835	9.515631	10.484369	51
10	9.493851	9.977794	9.516057	10.483942	50
11	9.494236	9.977752	9.516484	10.483516	49
12	9.494620	9.977711	9.516910	10.483090	48
13	9.495005	9.977669	9.517335	10.482665	47
14	9.495388	9.977628	9.517761	10.482239	46
15	9.495771	9.977586	9.518185	10.481814	45
16	9.496154	9.977544	9.518610	10.481390	44
17	9.496537	9.977503	9.519034	10.480966	43
18	9.496919	9.977461	9.519458	10.480542	42
19	9.497301	9 977419	9.519882	10.480118	41
20	9.497682	9.977377	9.520305	10.489695	40
21	9.498063	9.977335	9.520728	10.479272	39
22	9.498444	9.977293	9.521151	10.478849	38
23	9.498824	9.977251	9.521573	10.478427	37
24	9.499204	9.977209	9.521995	10.478005	36
25	9.499584	9.977167	9.522417	10.477583	35
26	9.499963	9.977125	9.522838	10.477162	34
27	9.500342	9.977083	9.523259	10.476741	33
28	9.500720	9.977041	9.523679	10.476320	32
29	9.501099	9.977999	9.524109	10.475900	31
30	9.501476	9.977956	9.524520	10.475480	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 71.

Degree 18.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.50147[illegible]	9.976956	9.524520	10.475480	30
31	9.501854	9.976914	9.524939	10.475060	29
32	9.502231	9.976872	9.525359	10.474641	28
33	9.502607	9.976830	9.525778	10.474222	27
34	9.502984	9.976787	9.526197	10.473803	26
35	9.503360	9.976745	9.526615	10.473385	25
36	9.503735	9.976702	9.527033	10.472967	24
37	9.504110	9.976660	9.527451	10.472549	23
38	9.504485	9.976617	9.527868	10.472132	22
39	9.504840	9.976574	9.528285	10.471715	21
40	9.505234	9.976532	9.5[illegible]87[illegible]2	10.471298	20
41	9.505608	9.976489	9.529118	10.470881	19
42	9.505981	9.976446	9.529535	10.470465	18
43	9.506354	9.976404	9.529950	10.470049	17
44	9.506727	9.976361	9.530366	10.469634	16
45	9.507099	9.976318	9.530781	10.469219	15
46	9.507471	9.976275	9.531196	10.468804	14
47	9.507843	9.976232	9.531611	10.468389	13
48	9.508214	9.976185	9.532025	10.467975	12
49	9.508585	9.976146	9.532436	10.467561	11
50	9.508955	9.976103	9.532852	10.467147	10
51	9.509326	9.976060	9.533266	10.466734	9
52	9.509696	9.976017	9.533679	10.466321	8
53	9.510065	9.975973	9.534092	10.465908	7
54	9.510434	9.975930	9.534504	10.465496	6
55	9.510803	9.97588	9.534916	10.465084	5
56	9.511171	9.975844	9.535328	10.464672	4
57	9.511540	9.975800	9.535739	10.464261	3
58	9.511907	9.975757	9.536150	10.463849	2
59	9.512275	9.975713	9.536561	10.463439	1
60	9.512642	9.975670	9.536972	10.463028	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 71.

Degree 19.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.512642	9.975670	9.536972	10.463028	60
1	9.513009	9.975626	9.537382	10.462618	59
2	9.513375	9.975583	9.537792	10.462208	58
3	9.513741	9.975539	9.538202	10.461798	57
4	9.514107	9.975496	9.538610	10.461389	56
5	9.514472	9.975452	9.539020	10.460980	55
6	9.514837	9.975408	9.539429	10.460571	54
7	9.515202	9.975364	9.539837	10.460163	53
8	9.515566	9.975321	9.540245	10.459755	52
9	9.515930	9.975277	9.540653	10.459347	51
10	9.516294	9.975233	9.541061	10.458939	50
11	9.516657	9.975189	9.541468	10.458532	49
12	9.517020	9.975145	9.541875	10.458125	48
13	9.517382	9.975101	9.542281	10.457719	47
14	9.517745	9.975057	9.542688	10.457312	46
15	9.518107	9.975013	9.543094	10.456906	45
16	9.518468	9.974969	9.543499	10.456501	44
17	9.518829	9.974925	9.543905	10.456095	43
18	9.519190	9.974880	9.544310	10.455690	42
19	9.519551	9.974836	9.544715	10.455285	41
20	9.519911	9.974792	9.545119	10.454881	40
21	9.520271	9.974747	9.545524	10.454476	39
22	9.520631	9.974703	9.5459[illegible]7	10.454072	38
23	9.520990	9.974659	9.546331	10.453669	37
24	9.521349	9.974614	9.546735	10.453265	36
25	9.521707	9.974570	9.547138	10.452862	35
26	9.522065	9.974525	9.547540	10.452459	34
27	9.522423	9.974480	9.547943	10.452057	33
28	9.522781	9.974436	9.548345	10.451655	32
29	9.523138	9.974391	9.548747	10.451253	31
30	9.523495	9.974346	9.549149	10.450851	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 70.

Degree 19.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.523495	9.974346	9.549149	10.450851	30
31	9.523851	9.974302	9.549550	10.450450	29
32	9.524208	9.974257	9.549951	10.450049	28
33	9.524564	9.974212	9.550352	10.449648	27
34	9.524920	9.974167	9.550752	10.449248	26
35	9.525275	9.974122	9.551152	10.448848	25
36	9.525630	9.974077	9.551552	10.448448	24
37	9.525984	9.974032	9.551952	10.448048	23
38	9.526339	9.973987	9.552351	10.447649	22
39	9.526693	9.973942	9.552750	10.447250	21
40	9.527046	9.973897	9.553149	10.446851	20
41	9.527400	9.973852	9.553548	10.446452	19
42	9 527753	9.973807	9.553946	10.446054	18
43	9.528105	9.973761	9.554344	10.445656	17
44	9.528458	9.973716	9.5 4741	10.445259	16
45	9.528810	9.973671	9.555139	10.444861	15
46	9.529161	9.9736 5	9.5 5536	10.444464	14
47	9.529513	9.973580	9.555932	10.444068	13
48	9.529864	9.973535	9.556329	10.443671	12
49	9.530214	9.973489	9.5 672	10.443275	11
50	9.530565	9.973443	9.557121	10.442879	10
51	9.5309 5	9.973398	9.557517	10.442483	9
52	9.531265	9.973352	9.557912	10.442088	8
53	9.531614	9.973307	9.558308	10.441693	7
54	9.531963	9.973261	9.558702	10.441298	6
55	9 532312	9.973215	9.559097	10.440903	5
56	9.532661	9.973169	9.559491	10.440509	4
57	9.533009	9.973123	9.559885	10.440115	3
58	9.533357	9.973078	9.560279	10.439721	2
59	9.533704	9.973032	9.560673	10.439327	1
60	9.534052	9.972986	9.561066	10.438934	0
	Co-sine	Sine	Co tang.	Tangent	M

Degree 70.

Degree 20.

M	Sine	*Co-sine*	Tangent	*Co-tang*	
0	9.534052	9.972986	9.561066	10.438934	60
1	9.534399	9.972940	9.561459	10.438541	59
2	9.534746	9.972894	9.561851	10.438148	58
3	9.535091	9.972848	9.562244	10.437756	57
4	9.535437	9.972801	9.562636	10.437364	56
5	9.535782	9.972755	9.563028	10.436972	55
6	9.536129	9.972709	9.563419	10.436580	54
7	9.536474	9.972663	9.563811	10.436189	53
8	9.536818	9.972617	9.564202	10.435798	52
9	9.537163	9.972570	9.564592	10.435407	51
10	9.537507	9.972524	9.564983	10.435017	50
11	9.537851	9.972477	9.565373	10.434[illegible]27	49
12	9.538194	9.972431	9.565763	10.434237	48
13	9.538537	9.972384	9.566153	10.433847	47
14	9.538880	9.972338	9.566542	10.433457	46
15	9.539222	9.972291	9.566932	10.433068	45
16	9.539565	9.972245	9.567320	10.432679	44
17	9.539907	9.972198	9.567709	10.432291	43
18	9.540249	9.972151	9.568097	10.431902	42
19	9.540590	9.972105	9.568486	10.431514	41
20	9.540931	9.972058	9.568873	10.431126	40
21	9.541272	9.972011	9.569261	10.430739	39
22	9.541612	9.971964	9.569648	10.430351	38
23	9.541953	9.971917	9.570035	10. 29964	37
24	9.54229[illegible]	9.971870	9.570422	10.429578	36
25	9.542632	9.971823	9.570809	10. 29191	35
26	9.542971	9.971776	9.571195	10.428805	34
27	9.543310	9.971729	9.571581	10.428419	33
28	9.543649	9.971682	9.571967	10.428033	32
29	9.543987	9.971635	9.572352	10.427648	31
30	9.544325	9.971588	9.572738	10.427262	30
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 69.

Degree 20.

M	Sine	Co-sine	Tangent	Co-tang	
30	9.544325	9.971588	9.572738	15.427262	30
31	9.544663	9.971540	9.573123	10.426877	29
32	9.545000	9.971493	9.573507	10.426492	28
33	9.545338	9.971446	9.573892	10.426108	27
34	9.545674	9.971398	9.574276	10.425724	26
35	9.546011	9.971351	9.574660	10.425340	25
36	9.546347	9.971303	9.575044	10.424956	24
37	9.546683	9.971256	9.575427	10.424573	23
38	9.547019	9.971208	9.575810	10.424189	22
39	9.547354	9.971161	9.576193	10.423807	21
40	9.547689	9.971112	9.576576	10.423424	20
41	9.548024	9.971065	9.576958	10.423041	19
42	9.548358	9.971018	9.577341	10.422659	18
43	9.548693	9.970970	9.577723	10.422277	17
44	9.549026	9.970922	9.578104	10.421896	16
45	9.549360	9.970874	9.578486	10.421514	15
46	9.549693	9.970826	9.578867	10.421133	14
47	9.550026	9.970779	9.579248	10.420752	13
48	9.550359	9.970731	9.579628	10.420371	12
49	9.550692	9.970683	9.580009	10.419991	11
50	9.551024	9.970634	9.580389	10.419611	10
51	9.551355	9.970586	9.580769	10.419231	9
52	9.551687	9.970538	9.581149	10.418851	8
53	9.552018	9.970490	9.581528	10.418472	7
54	9.552349	9.970442	9.581907	10.418092	6
55	9.552680	9.970394	9.582286	10.417713	5
56	9.553010	9.970345	9.582665	10.417335	4
57	9.553340	9.970297	9.583043	10.416956	3
58	9.553670	9.970249	9.583422	10.416578	2
59	9.554000	9.970200	9.583800	10.416200	1
60	[illegible]	[illegible]	9.584177	10.415823	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 69.

Degree 21.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.554329	9.970152	9.584177	10.415822	60
1	9.554658	9.970103	9.584555	10.415445	59
2	9.554987	9.970055	9.584932	10.415068	58
3	9.555315	9.970006	9.585308	10.414691	57
4	9.555643	9.969957	9.585686	10.414314	56
5	9.555971	9.969909	9.586062	10.413938	55
6	9.556299	9.969860	9.586439	10.413561	54
7	9.556626	9.969811	9.586815	10.413185	53
8	9.556953	9.969762	9.587190	10.412800	52
9	9.557279	9.969713	9.587566	10.412434	51
10	9.557606	9.969665	9.587941	10.412059	50
11	9.557932	9.969616	9.588316	10.411684	49
12	9.558258	9.969567	9.588691	10.411309	48
13	9.558583	9.969518	9.589066	10.410934	47
14	9.558909	9.969469	9.589440	10.410560	46
15	9.559234	9.969419	9.589814	10.410185	45
16	9.559558	9.969370	9.590188	10.409812	44
17	9.559883	9.969321	9.590561	10.409438	43
18	9.560207	9.969272	9.590935	10.409065	42
19	9.560531	9.969223	9.591308	10.408692	41
20	9.560855	9.969173	9.591681	10.408319	40
21	9.561178	9.969124	9.592054	10.407946	39
22	9.561501	9.969075	9.592426	10.407574	38
23	9.561824	9.969025	9.592798	10.407201	37
24	9.562146	9.968976	9.593170	10.406829	36
25	9.562468	9.968926	9.593542	10.406457	35
26	9.562790	9.968877	9.593914	10.406086	34
27	9.563112	9.968827	9.594285	10.405715	33
28	9.563433	9.968777	9.594656	10.405344	32
29	9.563754	9.968728	9.595027	10.405073	31
30	9.564075	9.668678	9.595397	10.404602	30
	Co-sine	Sine	*Co tang*	Tangent	M

Degree 68.

Degree 21.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.564075	9.968678	9.595397	10.404602	30
31	9.564396	9.968628	9.595768	10.404232	29
32	9.564716	9.968578	9.596138	10.403862	28
33	9.565036	9.968528	9.596508	10.403492	27
34	9.565356	9.968478	9.596878	10.403122	26
35	9.565675	9.968428	9.597247	10.402753	25
36	9.565995	9.968378	9.597616	10.402384	24
37	9.566314	9.968328	9.597985	10.402015	23
38	9.566632	9.968278	9.598354	10.401646	22
39	9.566951	9.968228	9.598722	10.401277	21
40	9.567269	9.968178	9.599091	10.400909	20
41	9.567587	9.968128	9.599459	10.400541	19
42	9.567904	9.968078	9.599827	10.400173	18
43	9.568222	9.968027	9.600194	10.399806	17
44	9.568539	9.967977	9.600562	10.399438	16
45	9.568855	9.967927	9.600929	10.399071	15
46	9.569172	9.967876	9.601296	10.398704	14
47	9.569488	9.967826	9.601662	10.398337	13
48	9.569804	9.967775	9.602029	10.397971	12
49	9.570120	9.967725	9.602395	10.397605	11
50	9.570435	9.967674	9.602761	10.397239	10
51	9.570751	9.967623	9.603127	10.396873	9
52	9.571065	9.967573	9.603493	10.396507	8
53	9.571380	9.967522	9.603858	10.396142	7
54	9.571695	9.967471	9.604223	10.395777	6
55	9.572009	9.967420	9.904588	10.395412	5
56	9.572322	9.967370	9.604953	10.395047	4
57	9.572636	9.967319	9.605317	10.394683	3
58	9.572949	9.967268	9.605681	10.394318	2
59	9.573263	9.967217	9.606046	10.393954	1
60	9.573575	9.967166	9.606409	10.393590	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 68.

Degree 22.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.573575	9.967166	9.606409	10.393590	60
1	9.573888	9.967115	9.606773	10.393227	59
2	9.574200	9.967064	9.607136	10.392863	58
3	9.574512	9.967012	9.607500	10.392500	57
4	9.574824	9.966961	9.607862	10.392137	56
5	9.575135	9.966910	9.608225	10.391774	55
6	9.575447	9.966859	9.608588	10.391412	54
7	9.575758	9.966807	9.608950	10.391050	53
8	9.576068	9.966756	9.609312	10.390688	52
9	9.576379	9.966705	9.609674	10.390326	51
10	9.576689	9.966653	9.600036	10.389964	50
11	9.576999	9.966602	9.610397	10.389603	49
12	9.577309	9.966550	9.610 58	10.389241	48
13	9.577618	9.966499	9.611119	10.388880	47
14	9.577927	9.966447	9.611480	10.388520	46
15	9.578236	9.966395	9.611841	10.388159	45
16	9.578545	9.966344	9.612201	10.387799	44
17	9.578853	9.966292	9.612561	10.387438	43
18	9.579161	9.966240	9.612921	10.387078	42
19	9.579469	9.966188	9.613281	10.386719	41
20	9.579777	9.966136	9.61364[illegible]	10.386359	40
21	9.580084	9.966084	9.614000	10.386000	39
22	9.580392	9.966032	9.614359	10.385641	38
23	9.580698	9.965980	9 614718	10.38528[illegible]	37
24	9.581005	9.965928	9.615077	10.384923	36
25	9.581311	9.965876	9.615435	10.384565	35
26	9.581618	9.965824	9.615793	10.384207	34
27	9.581923	9.965772	9.616151	10.383448	33
28	9.582229	9.965720	9.616509	10.383491	32
29	9.582534	9.965668	9.616867	10.383133	31
30	9.582840	9.965615	9.617224	10.382776	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 67.

D. gree 22.

M	Sine	Co-sine	Tangen.	Co tang.	
30	9.582840	9.965615	9.617224	10.382776	30
31	9.583144	9.965563	9.617581	10.382418	29
32	9.583449	9.965511	9.617938	10.382061	28
33	9.583753	9.965458	9.618295	10.381705	27
34	9.584058	9.965406	9.618652	10.381348	26
35	9.584361	9.965353	9.619008	10.380992	25
36	9.584665	9.965301	9.619364	10.380635	24
37	9.584968	9.965248	9.619720	10.380279	23
38	9.585271	9.965195	9.620076	10.379924	22
39	9.585574	9.965143	9.620432	10.379568	21
40	9.585877	9.965090	9.620787	10.379213	20
41	9.586179	9.965037	9.621142	10.378858	19
42	9.586481	9.964984	9.521497	10.378503	18
43	9.586783	9.964931	9.621852	10.378148	17
44	9.587085	9.964878	9.622206	10.377793	16
45	9.587386	9.964825	9.622561	10.377439	15
46	9.587687	9.964772	9.622915	10.37[illegible]085	14
47	9.587988	9.964719	9.623269	10.376731	13
48	9.588289	9.964666	9.623623	10.376[illegible]77	12
49	9.588589	9.964613	9.623976	10.376024	11
50	9.588890	9.964560	9.624330	10.375670	10
51	9.589190	9.964507	9.624683	10.375317	9
52	9.589489	9.964454	9.625036	10.374964	8
53	9.589789	9.964400	9.625388	10.374612	7
54	9.590088	9.964347	9.625741	10.374259	6
55	9.590387	9.964294	9.626093	10.373907	5
56	9.590686	9.964240	9.6[illegible]6445	10.373555	4
57	9.590984	9.964187	9.626797	10.373203	3
58	9.591282	9.964133	9.627149	10.37[illegible]850	2
59	9.591580	9.96408	9.527501	10.372499	1
60	9.591878	9.964026	9.627852	10.372148	0
	Co-fine	Sine	Co-tang	Tangent	M

Degree 67.

Degree 23.

M	Sine	Co sine	Tangent	Co-tang.	
0	9.591878	9.964026	9.627852	10.372148	60
1	9.592175	9.963972	9.628203	10.371797	59
2	9.592473	9.963919	9.628554	10.371446	58
3	9.592770	9.963865	9.628905	10.371095	57
4	9.593067	9.963811	9.629255	10.370744	56
5	9.593363	9.963757	9.629606	10.370394	55
6	9.593659	9.963703	9.629956	10.370044	54
7	9.593955	9.963650	9.630306	10.369694	53
8	9.594251	9.963596	9.630655	10.369344	52
9	9.594547	9.963542	9.631005	10.368995	51
10	9.594842	9.963488	9.631354	10.368645	50
11	9.595137	9.963433	9.631704	10.368296	49
12	9.595432	9.963379	9.632053	10.367947	48
13	9.595727	9.963325	9.632401	10.367598	47
14	9.596021	9.963271	9.632750	10.367250	46
15	9.596315	9.963217	9.633098	10.366901	45
16	9.596610	9.963102	9.633447	10.366553	44
17	9.596903	9.963108	9.633795	10.366205	43
18	9.597196	9.963054	9.634143	10.365857	42
19	9.597490	9.962999	9.634490	10.365510	41
20	9.597783	9.962945	9.634838	10.365162	40
21	9.598075	9.962892	9.635185	10.364815	39
22	9.598368	9.962836	9.635530	10.364468	38
23	9.598660	9.962781	9.635879	10.364121	37
24	9.598952	9.962726	9.636226	10.363774	36
25	9.599244	9.962672	9.636572	10.363428	35
26	9.599536	9.962617	9.636918	10.363081	34
27	9.599827	9.962562	9.637205	10.362735	33
28	9.600118	9.962507	9.637610	10.362389	32
29	9.600409	9.962453	9.637956	10.362044	31
30	9.600700	9.962398	9.638302	10.361698	30
	Co sine	Sine	Co-tang.	Tangent	M

Degree 66.

Degree 23.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.600700	9.962398	9.638302	10.361698	30
31	9.600990	9.962343	9.638647	10.361353	29
32	9.601280	9.962288	9.638992	10.361007	28
33	9.601570	9.962233	9.639337	10.360662	27
34	9.601860	9.962178	9.639682	10.360318	26
35	9.602149	9.962122	9.640027	10.359973	25
36	9.602439	9.962067	9.640371	10.359629	24
37	9.602728	9.962012	9.640716	10.359284	23
38	9.603017	9.961957	9.641060	10.358940	22
39	9.603305	9.961902	9.641404	10.358596	21
40	9.603594	9.961846	9.641747	10.358253	20
41	9.603882	9.961791	9.642091	10.357909	19
42	9.604170	9.961735	9.642434	10.357566	18
43	9.604457	9.961680	9.642777	10.357223	17
44	9.604745	9.961624	9.643120	10.356980	16
45	9.605032	9.961569	9.643463	10.356537	15
46	9.605319	9.961513	9.643806	10.356194	14
47	9.605606	9.961458	9.644148	10.355852	13
48	9.605892	9.961402	9.644490	10.355510	12
49	9.606179	9.961346	9.644832	10.355168	11
50	9.606465	9.961290	9.645174	10.354826	10
51	9.606750	9.961235	9.645516	10.354484	9
52	9.607036	9.961179	9.645857	10.354142	8
53	9.607322	9.961123	9.646 99	10.353801	7
54	9.607607	9.961067	9.64654	10.3534[illegible]	6
55	9.607892	9.961011	9.646881	10.353119	5
56	9.608176	9.960955	9.647222	10.352778	4
57	9.608461	9.960899	9.647562	10.352438	3
58	9.608745	9.960842	9.647903	10.352097	2
59	9.60902	9.960786	9.648243	10.351757	1
60	9.609313	9.960730	9.648583	10.351417	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 66.

Degree 24.

M	Sine	Co-sine	Tangen.	Co-tang.	
0	9.609313	9.960730	9.648583	10.351417	60
1	9.609597	9.960674	9.648923	10.351077	59
2	9.609880	9.960617	9.649263	10.350737	58
3	9.610163	9.960561	9.649602	10.350398	57
4	9.610446	9.960505	9.649942	10.350058	56
5	9.610729	9.960448	9.650281	10.349319	55
6	9.611012	9.960392	9.650620	10.349380	54
7	9.611294	9.960335	9.650959	10.349041	53
8	9.611576	9.960279	9.651297	10.348703	52
9	9.611858	9.960222	9.651636	10.348364	51
10	9.612140	9.960165	9.651974	10.348026	50
11	9.612421	9.960109	9.652312	10.347688	49
12	9.612702	9.960052	9.652650	10.347350	48
13	9.612983	9.959995	9.652988	10.347012	47
14	9.613264	9.959938	9.653326	10.346674	46
15	9.613545	9.959881	9.653663	10.346337	45
16	9.613825	9.959824	9.654000	10.345999	44
17	9.614105	9.959768	9.654337	10.345662	43
18	9.614385	9.959710	9.654674	10.345325	42
19	9.614665	9.959653	9.655011	10.344989	41
20	9.614944	9.959596	9.655348	10.344652	40
21	9.615223	9.959539	9.655684	10.344316	39
22	9.615502	9.959482	9.656020	10.343980	38
23	9.615781	9.959425	9.656356	10.343643	37
24	9.616060	9.959367	9.656692	10.343308	36
25	9.616338	9.959310	9.657028	10.342972	35
26	9.616616	9.959253	9.657363	10.342636	34
27	9.616894	9.959195	9.657699	10.342301	33
28	9.617172	9.959138	9.658034	10.341966	32
29	9.617450	9.959080	9.658369	10.341531	31
30	9.617727	9.959023	9.658704	10.341296	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 65

Degree 24.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.617727	9.959023	9.658704	10.341296	30
31	9.618004	9.958965	9.659039	10.340926	29
32	9.618281	9.958908	9.659373	10.340627	28
33	9.618558	9.958850	9.659708	10.340292	27
34	9.618834	9.958792	9.660042	10.339958	26
35	9.619110	9.958734	9.660376	10.339624	25
36	9.619386	9.958677	9.660710	10.339290	24
37	9.619662	9.958619	9.661043	10.338957	23
38	9.619938	9.958561	9.661377	10.338623	22
39	9.620213	9.958503	9.661710	10.338290	21
40	9.620488	9.958445	9.662043	10.337956	20
41	9.620763	9.958387	9.662376	10.337623	19
42	9.621038	9.958329	9.662709	10.337291	18
43	9.621313	9.958271	9.663042	10.336958	17
44	9.621587	9.958212	9.663374	10.336625	16
45	9.621861	9.958154	9.663707	10.336293	15
46	9.622135	9.958096	9.664039	10.335961	14
47	9.622409	9.958038	9.664371	10.335629	13
48	9.622682	9.957979	9.664703	10.335297	12
49	9.622956	9.957921	9.665035	10.334965	11
50	9.623229	9.957862	9.665366	10.334634	10
51	9.623502	9.957804	9.665697	10.334302	9
52	9.623774	9.957745	9.666029	10.333971	8
53	9.624047	9.957687	9.666360	10.333640	7
54	9.624319	9.957628	9.666691	10.333309	6
55	9.624591	9.957570	9.667021	10.332979	5
56	9.624863	9.957511	9.667352	10.332648	4
57	9.625134	9.957452	9.667682	10.332318	3
58	9.625406	9.957393	9.668012	10.331987	2
59	9.625677	9.957334	9.668343	10.331657	1
60	9.625948	9.957276	9.66867	0.331327	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 65.

Degree 25.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.625948	9.957276	9.668672	10.331327	60
1	9.626219	9.957217	9.669002	10.330998	59
2	9.626490	9.957158	9.669332	10.330668	58
3	9.626760	9.957099	9.669661	10.330339	57
4	9.627030	9.957040	9.699990	10.330009	56
5	9.627300	9.956981	9.670320	10.329680	55
6	9.627570	9.956922	9.670649	10.329351	54
7	9.627840	9.956862	9.670977	10.329022	53
8	9.628109	9.956803	9.671306	10.328694	52
9	9.628378	9.956744	9.671634	10.328365	51
10	9.628647	9.956684	9.671963	10.328037	50
11	9.628916	9.956625	9.672291	10.327709	49
12	9.629184	9.956565	9.672619	10.327381	48
13	9.629453	9.956506	9.672947	10.327053	47
14	9.629721	9.956446	9.673274	10.326725	46
15	9.629989	9.956387	9.673603	10.326398	45
16	9.630257	9.956327	9.673929	10.326070	44
17	9.630524	9.956267	9.674256	10.325743	43
18	9.630792	9.956208	9.674584	10.325416	42
19	9.631059	9.956148	9.674910	10.325089	41
20	9.631326	9.956088	9.675237	10.324763	40
21	9.631592	9.956029	9.675564	10.324436	39
22	9.631859	9.955969	9.675890	10.324110	38
23	9.632125	9.955909	9.676216	10.323783	37
24	9.632392	9.955849	9.676543	10.323457	36
25	9.632657	9.955789	9.676869	10.323131	35
26	9.632923	9.955739	9.677194	10.322805	34
27	9.633189	9.955669	9.677520	10.322480	33
28	9.633454	9.955609	9.677845	10.322154	32
29	9.633719	9.955548	9.678171	10.321829	31
30	9.633984	9.955488	9.67849[illegible]	10.321504	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 64.

Degree 25.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.633984	9.955488	9.678496	10.321504	30
31	9.634249	9.955428	9.678821	10.321179	29
32	9.634514	9.955367	9.679146	10.320854	28
33	9.634778	9.955307	9.679471	10.320529	27
34	9.635042	9.955246	9.679795	10.320205	26
35	9.635306	9.955186	9.680120	10.319880	25
36	9.635570	9.955125	9.680444	10.319556	24
37	9.635833	9.955065	9.680768	10.319232	23
38	9.636097	9.955004	9.681092	10.318908	22
39	9.636360	9.954944	9.681416	10.318584	21
40	9.636623	9.954883	9.681740	10.318260	20
41	9.636886	9.954823	9.682063	10.317937	19
42	9.637148	9.954762	9.682386	10.317613	18
43	9.637411	9.954701	9.682710	10.317290	17
44	9.637673	9.954640	9.683033	10.316967	16
45	9.637935	9.954579	9.683356	10.316644	15
46	9.638197	9.954518	9.683678	10.316321	14
47	9.638458	9.954457	9.684001	10.315999	13
48	9.638720	9.954396	9.684324	10.315676	12
49	9.638981	9.954335	9.684646	10.315354	11
50	9.639242	9.954274	9.684968	10.315032	10
51	9.639503	9.954213	9.685290	10.314710	9
52	9.639764	9.954152	9.685612	10.313388	8
53	9.640024	9.954090	9.685934	10.314066	7
54	9.640284	9.954029	9.686255	10.313745	6
55	9.640544	9.954968	9.686577	10.313423	5
56	9.640804	9.953906	9.686898	10.313102	4
57	9.641064	9.953845	9.687219	10.312781	3
58	9.641323	9.953783	9.687540	10.312460	2
59	9.641583	9.953722	9.687861	10.312138	1
60	9.641842	9.953660	9.688182	10.311818	0
	Co-sine	Sine	Co tang.	Tangent	M

Degree 64.

Degree 26.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.641842	9.953660	9.688182	10.311818	60
1	9.642101	9.953598	9.688502	10.311498	59
2	9.642360	9.953537	9.688823	10.311177	58
3	9.642618	9.953475	9.689143	10.310857	57
4	9.642876	9.953413	9.689463	10.310537	56
5	9.643135	9.953351	9.689783	10.3102 7	55
6	9.643393	9.953290	9.690103	10.309897	54
7	9.643650	9.953228	9.690423	10.309577	53
8	9.643908	9.953166	9.690742	10.309258	52
9	9.644165	9.953104	9.691063	10.308938	51
10	9.644423	9.953042	9.691381	10.308619	50
11	9.644680	9.952980	9.691700	10.308300	49
12	9.644936	9.952917	9.692019	10.307981	48
13	9.645193	9.952855	9.692338	10.307662	47
14	9.645449	9.952793	9.692656	10.307343	46
15	9.645706	9.952731	9.692975	10.307025	45
16	9.645962	9.952668	9.693293	10.306706	44
17	9.646218	9.952606	9.693612	10.306388	43
18	9.646473	9.952544	9.693930	10.306070	42
19	9.646729	9.952481	9.694248	10.305752	41
20	9.646984	9.952419	9.694566	10.305434	40
21	9.647239	9.952356	9.694883	10.305117	39
22	9.647494	9.952294	9.695201	10.304799	38
23	9.647749	9.952231	9.695518	10.304482	37
24	9.648004	9.952168	9.695835	10.304164	36
25	9.648258	9.952105	9.696153	10.303847	35
26	9.648512	9.952043	9.696470	10.303530	34
27	9.648766	9.951980	9.696786	10.303213	33
28	9.648020	9.951917	9.697103	10.302897	32
29	9.649274	9.951854	9.697420	10.302580	31
30	9.649527	9.951791	9.697738	10.302264	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 63.

Degree 26.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.649527	9.951791	9.697738	10.302264	30
31	9.649781	9.951728	9.698052	10.301947	29
32	9.650034	9.951665	9.698369	10.301631	28
33	9.650287	9.951602	9.698685	10.301315	27
34	9.650519	9.951539	9.699001	10.300999	26
35	9.650798	9.951476	9.699316	10.300684	25
36	9.651044	9.951412	9.699632	10.300368	24
37	9.651296	9.951349	9.699947	10.300052	23
38	9.651648	9.951286	9.700263	10.299737	22
39	9.651800	9.951222	9.700578	10.299422	21
40	9.652052	9.951159	9.700893	10.299107	20
41	9.652303	9.951095	9.701208	10.298792	19
42	9.652555	9.951032	9.701523	10.298477	18
43	9.652806	9.950968	9.701837	10.298163	17
44	9.653057	9.950905	9.702152	10.297848	16
45	9.653307	9.950841	9.702466	10.297534	15
46	9.653558	9.950777	9.702780	10.297219	14
47	9.653808	9.950714	9.703095	10.296905	13
48	9.654059	9.950650	9.703409	10.296591	12
49	9.654309	9.950586	9.703722	10.296277	11
50	9.654558	9.950522	9.704036	10.295964	10
51	9.654808	9.950458	9.704350	10.295650	9
52	9.655057	9.950394	9.704663	10.295337	8
53	9.655307	9.950330	9.704976	10.295023	7
54	9.655556	9.950266	9.705290	10.294710	6
55	9.655805	9.950202	9.705603	10.294397	5
56	9.656053	9.950138	9.705915	10.294084	4
57	9.656302	9.950074	9.706228	10.293771	3
58	9.656550	9.950009	9.706541	10.293459	2
59	9.656799	9.949945	9.706853	10.293146	1
60	9.656347	9.949881	9.707166	10.292834	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 63.

Degree 27.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.657047	9.949880	9.707166	10.292834	60
1	9.657295	9.949816	9.707478	10.292523	59
2	9.657542	9.949752	9.707790	10.292210	58
3	9.657790	9.949687	9.708102	10.291897	57
4	9.658037	9.949623	9.708414	10.291586	56
5	9.658284	9.949598	9.708726	10.291274	55
6	9.658531	9.949494	9.709037	10.290962	54
7	9.658777	9.949429	9.709349	10.290651	53
8	9.659024	9.949364	9.709660	10.290340	52
9	9.659271	9.949300	9.709971	10.290029	51
10	9.659517	9.949235	9.710282	10.289718	50
11	9.659763	9.949170	9.710593	10.289407	49
12	9.660009	9.949105	9.710904	10.289096	48
13	9.660255	9.949040	9.711214	10.288785	47
14	9.660500	9.948976	9.711525	10.288475	46
15	9.660746	9.948910	9.711836	10.288164	45
16	9.660991	9.948845	9.712146	10.287854	44
17	9.661036	9.948760	9.712456	10.287544	43
18	9.661481	9.948715	9.712766	10.287234	42
19	9.661726	9.948650	9.713076	10.286924	41
20	9.661970	9.948584	9.713386	10.286614	40
21	9.662214	9.948519	9.713695	10.286305	39
22	9.662459	9.948453	9.714005	10.285995	38
23	9.662702	9.948388	9.714314	10.285686	37
24	9.662947	9.948323	9.714624	10.285376	36
25	9.663190	9.948257	9.714933	10.285067	35
26	9.663433	9.948191	9.715241	10.284758	34
27	9.663677	9.948126	9.715550	10.284449	33
28	9.663920	9.948060	9.715859	10.284140	32
29	9.664163	9.947995	9.716168	10.283832	31
30	9.664406	9.947929	9.716477	10.283523	30
	Co-sine	Sine	Co tang	Tangent	M

Degree 62.

Degree 27.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.664406	9.947929	9.716477	10.283523	30
31	9.664648	9.947863	9.716785	10.283215	29
32	9.664891	9.947797	9.717093	10.282907	28
33	9.665133	9.947731	9.717401	10.282598	27
34	9.665375	9.947665	9.717709	10.282290	26
35	9.665617	9.947599	9.718017	10.281983	25
36	9.665858	9.947533	9.718325	10.281675	24
37	9.666100	9.947467	9.718633	10.281367	23
38	9.666341	9.947401	9.718940	10.281060	22
39	9.666583	9.947335	9.719248	10.280752	21
40	9.666824	9.947269	9.719555	10.280445	20
41	9.667065	9.947203	9.719862	10.280138	19
42	9.667305	9.947136	9.720169	10.279831	18
43	9.667546	9.947070	9.720476	10.279524	17
44	9.667786	9.947004	9.720783	10.279217	16
45	9.668026	9.946937	9.721089	10.278911	15
46	9.668266	9.946871	9.721395	10.278604	14
47	9.668506	9.946804	9.721702	10.278298	13
48	9.668746	9.946738	9.722008	10.277991	12
49	9.668986	9.946671	9.722315	10.277685	11
50	9.669225	9.946604	9.722621	10.277379	10
51	9.669464	9.946537	9.722927	10.277073	9
52	9.669703	9.946471	9.723232	10.276768	8
53	9.669942	9.946404	9.723538	10.276462	7
54	9.670181	9.946337	9.723843	10.276156	6
55	9.670419	9.946270	9.724149	10.275851	5
56	9.670657	9.946203	9.724454	10.275546	4
57	9.670896	9.946136	9.724759	10.275240	3
58	9.671134	9.946069	9.725065	10.274935	2
59	9.671372	9.946002	9.725369	10.274630	1
60	9.671609	9.945935	9.725674	10.274326	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 62.

Degree 28.

M	Sine	Co-sine	Tangent	Co tang.	
0	9.671609	9.945935	9.725674	10.274326	60
1	9.671847	9.945868	9.725979	10.274021	59
2	9.672084	9.945800	9.726284	10.273816	58
3	9.672321	9.945733	9.726588	10.273412	57
4	9.672558	9.945666	9.726892	10.273107	56
5	9.672795	9.945598	9.727197	10.272803	55
6	9.673032	9.945531	9.727501	10.272499	54
7	9.673268	9.945463	9.727805	10.272195	53
8	9.673505	9.945396	9.728109	10.271891	52
9	9.673741	9.945328	9.728412	10.271587	51
10	9.673977	9.945261	9.728716	10.271284	50
11	9.674213	9.945193	9.729020	10.270980	49
12	9.674448	9.945125	9.729323	10.270677	48
13	9.674684	9.945058	9.729626	10.270374	47
14	9.674919	9.944990	9.729929	10.270070	46
15	9.675154	9.944922	9.730232	10.269767	45
16	9.675389	9.944854	9.730535	10.269464	44
17	9.675623	9.944786	9.730838	10.269162	43
18	9.675859	9.944718	9.731141	10.268859	42
19	9.676094	9.944650	9.731443	10.268559	41
20	9.676328	9.944582	9.731746	10.268254	40
21	9.676562	9.944514	9.732048	10.267952	39
22	9.676796	9.944446	9.732351	10.267649	38
23	9.677030	9.944377	9.732653	10.267347	37
24	9.677264	9.944309	9.732955	10.267045	36
25	9.677497	9.944241	9.733257	10.266743	35
26	9.677731	9.944172	9.733558	10.266441	34
27	9.677964	9.944104	9.733860	10.266140	33
28	9.678197	9.944016	9.734162	10.265838	2
29	9.678430	9.943967	9.734463	10.265537	31
30	9.678663	9.943898	9.734764	10.265236	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 61.

Degree 28.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.678663	9.943898	9.734764	10.265236	30
31	9.678895	9.943830	9.735666	10.264934	29
32	9.679128	9.943761	9.735362	10.264633	28
33	9.670360	9.943692	9.735668	10.264332	27
34	9.679592	9.943624	9.735968	10.264031	26
35	9.679824	9.943555	9.736269	10.263731	25
36	9.680056	9.943486	9.736570	10.263430	24
37	9.680288	9.943417	9.736870	10.263130	23
38	9.680519	9.943348	9.737171	10.262829	22
39	9.680750	9.943279	9.737471	10.262529	21
40	9.680982	9.943210	9.737771	10.262229	20
41	9.681213	9.943141	9.738071	10.261929	19
42	9.681443	8.943072	9.738371	10.261629	18
43	9.681674	9.943003	9.738671	10.261329	17
44	9.681904	9.942933	9.738971	10.261029	16
45	9.682135	9.942864	9.739271	10.260729	15
46	9.682365	9.942795	9.739570	10.260430	14
47	9.682595	9.942725	9.739870	10.260130	13
48	9.682825	9.942656	9.740169	10.259831	12
49	9.683055	9.942587	9.740468	10.259532	11
50	9.633284	9.942517	9.740767	10.259233	10
51	9.683514	9.942448	9.741066	10.258934	9
52	9.683743	9.942378	9.741365	10.258635	8
53	9.683972	9.942308	9.741664	10.258336	7
54	9.684201	9.942239	9.741962	10.258038	6
55	9.684430	9.942169	9.742261	10.257739	5
56	9.684658	9.942099	9.742559	10.257441	4
57	9.684887	9.942029	9.742858	10.257142	3
58	9.685115	9.941059	9.743156	10.256844	2
59	9.685343	9.941889	9.743454	10.256546	1
60	9.685571	9.941819	9.743751	10.256248	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 61.

Degree 29.

M	Sine	Co sine	Tangent	Co-tang.	
0	9.685571	9.941819	9.743752	10.256248	60
1	9.685799	9.941749	9.744050	10.255950	59
2	9.686027	9.941679	9.744348	10.255652	58
3	9.686254	9.941609	9.744645	10.255355	57
4	9.686[illegible]82	9.941539	9.744943	10.255057	56
5	9.686709	9.941468	9.745240	10.254760	55
6	9.686936	9.941398	9.745538	10.254462	54
7	9.687163	9.941328	9.745835	10.254165	53
8	9.687389	9.941257	9.746132	10.253868	52
9	9.687616	9.941187	9.746429	10.253571	51
10	9.687842	9.941116	9.746726	10.253274	50
11	9.688069	9.941046	9.747023	10.252977	49
12	9.688295	9.940975	9.747319	10.252680	48
13	9.68[illegible]523	9.940905	9.747616	10.252384	47
14	9.688747	9.940834	9.747912	10.252087	46
15	9.688972	9.940763	9.748209	10.251791	45
16	9.689198	9.940693	9.748505	10.251495	44
17	9.689421	9.940622	9.748801	10.251199	43
18	9.689648	9.940551	9.749097	10.250902	42
19	9.689873	9.940480	9.749393	10.250607	41
20	9.690098	9.940409	9.749689	10.250311	40
21	9.690323	9.940338	9.749985	10.250015	39
22	9.690548	9.940267	9.750281	10.249719	38
23	9.690772	9.940196	9.750576	10.249424	37
24	9.690996	9.940125	9.750872	10.249128	36
25	9.691220	9.940053	9.751167	10.248833	35
26	9.691444	9.939982	9.751462	10.248538	34
27	9.691668	9.939911	9.751757	10.248243	33
28	9.691892	9.939840	9.752052	10.247948	32
29	9.692115	9.939768	9.752347	10.247653	31
30	9.692339	9.939697	9.752642	10.247358	30
	Co sine	Sine	Co-tang	Tangent	M

Degree 60.

Degree 29.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.692339	9.939697	9.752642	10.247358	30
31	9.692562	9.939625	9.752937	10.247063	29
32	9.692785	9.939554	9.753231	10.246769	28
33	9.693008	9.939482	9.753526	10.246474	27
34	9.693231	9.939410	9.753820	10.246180	26
35	9.693453	9.939339	9.754115	10.245885	25
36	9.693676	9.939267	9.754409	10.245591	24
37	9.693898	9.939195	9.754703	10.245297	23
38	9.694120	9.939123	9.754997	10.245003	22
39	9.694342	9.939051	9.755291	10.244709	21
40	9.694564	9.938980	9.755584	10.244415	20
41	9.694786	9.938908	9.755878	10.244122	19
42	9.695007	9.938835	9.756172	10.243828	18
43	9.695229	9.938763	9.756465	10.243535	17
44	9.695450	9.938691	9.756759	10.243241	16
45	9.695671	9.938619	9.757052	10.242948	15
46	9.695892	9.938547	9.757345	10.242655	14
47	9.696113	9.938475	9.757638	10.242362	13
48	9.696334	9.938402	9.757931	10.242069	12
49	9.696554	9.938330	9.758224	10.241776	11
50	9.696774	9.938257	9.758517	16.241483	10
51	9.696995	9.938185	9.758810	10.241190	9
52	9.697215	9.938112	9.759102	10.240898	8
53	9.697435	9.938040	9.759395	10.240605	7
54	9.697654	9.937967	9.759687	10.240313	6
55	9.697874	9.937895	9.759979	10.240021	5
56	9.698093	9.937822	9.760271	10.239728	4
57	9.698313	9.937749	9.760564	10.239436	3
58	9.698532	9.937676	9.760856	10.239144	2
59	9.698751	9.937603	9.761147	10.238852	1
60	9.698970	9.937531	9.761439	10.238561	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 60.

Degree 30.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.698970	9.937531	9.761439	10.238561	60
1	9.699189	9.937458	9.761731	10.238269	59
2	9.699407	9.937385	9.762023	10.237977	58
3	9.699626	9.937312	9.762314	10.237686	57
4	9.699844	9.937238	9.762606	10.237394	56
5	9.700062	9.937165	9.762897	10.237103	55
6	9.700280	9.937092	9.763188	10.236812	54
7	9.700498	9.937019	9.763479	10.236521	53
8	9.700716	9.936945	9.763770	10.236230	52
9	9.700933	9.936872	9.764061	10.235939	51
10	9.701151	9.936799	9.764352	10.235648	50
11	9.701568	9.936725	9.764643	10.235357	49
12	9.701585	9.936652	9.764933	10.235067	48
13	9.701802	9.936578	9.765224	10.234776	47
14	9.702019	9.936505	9.765514	10.234486	46
15	9.702236	9.936431	9.765805	10.234195	45
16	9.702452	9.936357	9.766095	10.233905	44
17	9.702669	9.936284	9.766385	10.233615	43
18	9.702885	9.936210	9.766675	10.233325	42
19	9.703101	9.936136	9.766965	10.233035	41
20	9.703317	9.936062	9.767255	10.232745	40
21	9.703533	9.935988	9.767545	10.232455	39
22	9.703748	9.935914	9.767834	10.232166	38
23	9.703964	9.935840	9.768124	10.231876	37
24	9.704179	9.935766	9.768413	10.231587	36
25	9.704395	9.935692	9.768703	10.231297	35
26	9.704610	9.935618	9.768992	10.231008	34
27	9.704820	9.935543	9.769281	10.230719	33
28	9.705040	9.935469	9.769570	10.230430	32
29	9.705254	9.935395	9.769859	10.230141	31
30	9.705469	9.935320	9.770148	10.229852	30
	Co-sine	Sine	Co tang	Tangent	M

Degree 59.

Degree 30.

M	Sine	Co-sine	Tangent	Co-tang	
30	9.705469	9.935320	9.770148	10.229852	30
31	9.705683	9.935246	9.770437	10.229563	29
32	9.705897	9.935171	9.770726	10.229274	28
33	9.706112	9.935097	9.771015	10.228985	27
34	9.706326	9.935022	9.771303	10.228697	26
35	9.706539	9.934948	9.771592	10.228408	25
36	9.706753	9.934873	9.771880	10.228120	24
37	9.706967	9.934798	9.772168	10.227832	23
38	9.707180	9.934723	9.772456	10.227543	22
39	9.707393	9.934649	9.772745	10.227255	21
40	9.707606	9.934574	9.773033	10.226967	20
41	9.707819	9.934499	9.773321	10.226679	19
42	9.708032	9.934424	9.773608	10.226391	18
43	9.708245	9.934349	9.773896	10.226104	17
44	9.708457	9.934274	9.774184	10.225816	16
45	9.708670	9.934199	9.774471	10.225529	15
46	9.708882	9.934123	9.774759	10.225241	14
47	9.709094	9.934048	9.775046	10.224954	13
48	9.709306	9.933973	9.775333	10.224666	12
49	9.709518	9.933897	9.775621	10.224379	11
50	9.709730	9.933822	9.775908	10.224092	10
51	9.709941	9.933747	9.776195	10.223805	9
52	9.710153	9.933671	9.776482	10.223518	8
53	9.710364	9.933596	9.776768	10.223232	7
54	9.710575	9.933520	9.777055	10.222945	6
55	9.710786	9.933444	9.777342	10.222658	5
56	9.710997	9.933369	9.777628	10.222372	4
57	9.711208	9.933293	9.777915	10.222085	3
58	9.711418	9.933217	9.778201	10.221799	2
59	9.711629	9.933141	9.778487	10.221513	1
60	9.711839	9.933066	9.778774	10.221226	0
	Co sine	Sine	Co tang.	Tangent	M

Degree 59.

Degree 31.

M	Sine	*Co-sine*	Tangent	*Co-tang*	
0	9.711839	9.933066	9.778774	10.221226	60
1	9.712049	9.932990	9.779060	10.220940	59
2	9.712259	9.932914	9.779346	10.220654	58
3	9.712469	9.932838	9.779632	10.220368	57
4	9.712679	9.932761	9.779918	10.220082	56
5	9.712889	9.932685	9.780203	10.219796	55
6	9.713098	9.932609	9.780489	10.219511	54
7	9.713308	9.932533	9.780775	10.219225	53
8	9.713517	9.932457	9.781060	10.218940	52
9	9.713726	9.932380	9.781346	10.218654	51
10	9.713935	9.932304	9.781631	10.218369	50
11	9.714144	9.932227	9.781916	10.218084	49
12	9.714352	9.932151	9.782202	10.217799	48
13	9.714561	9.932074	9.782486	10.217514	47
14	9.714769	9.931998	9.782771	10.217229	46
15	9.714977	9.931921	9.783056	10.216944	45
16	9.715186	9.931845	9.783341	10.216659	44
17	9.715394	9.931768	9.783626	10.216374	43
18	9.715601	9.931691	9.783910	10.216090	42
19	9.715809	9.931614	9.784195	10.215805	41
20	9.716017	9.931537	9.784479	10.215520	40
21	9.716224	9.931460	9.784764	10.215236	39
22	9.716431	9.931383	9.785048	10.214952	38
23	9.716639	9.931306	9.785332	10.214668	37
24	9.716846	9.931229	9.785616	10.214384	36
25	9.717053	9.931152	9.785900	10.214099	35
26	9.717259	9.931075	9.786184	10.213816	34
27	9.717466	9.930998	9.786468	10.213532	33
28	9.717672	9.930920	9.786752	10.213248	32
29	9.717879	9.930843	9.787036	10.212964	31
30	9.718085	9.930766	9.787319	10.21268	30
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 58.

Degree 31.

M	Sine	Co-ſine	Tangent	Co-tang.	
30	9.718085	9.930766	9.787319	10.212681	30
31	9.718291	9.930688	9.787603	10.212397	29
32	9.718497	9.930611	9.787886	10.212114	28
33	9.718703	9.930533	9.788170	10.211830	27
34	9.718909	9.930456	9.788453	10.211547	26
35	9.719114	9.930378	9.788736	10.211264	25
36	9.719320	9.930300	9.789019	10.210981	24
37	9.719525	9.930223	9.789302	10.210698	23
38	9.719730	9.930145	9.789585	10.210415	22
39	9.719935	9.930067	9.789868	10.210132	21
40	9.720140	9.929989	9.790151	10.209849	20
41	9.720345	9.929911	9.790433	10.209566	19
41	9.720549	9.929833	9.790716	10.209284	18
43	9.720754	9.929755	9.790999	10.209001	17
44	9.720958	9.929677	9.790281	10.208719	16
45	9.721162	9.929599	9.791563	10.208436	15
46	9.721366	9.929521	9.791846	10.208154	14
47	9.721570	9.929442	9.792128	10.207872	13
48	9.721774	9.929364	9.792410	10.207590	12
49	9.721978	9.929286	9.792692	10.207308	11
50	9.722181	9.929207	9.792974	10.207024	10
51	9.722385	9.929129	9.793256	10.206744	9
52	9.722588	9.929050	9.793538	10.206462	8
53	9.722791	9.928972	9.793819	10.206180	7
54	9.722994	9.928893	9.794101	10.205899	6
55	9.723197	9.928814	9.794383	10.205617	5
56	9.723400	9.928736	9.794664	10.205336	4
57	9.723603	9.928657	9.794945	10.205054	3
58	9.723805	9.928578	9.795227	10.204773	2
59	9.724007	9.928499	9.795508	10.204492	1
60	9.724210	9.928420	9.795789	10.204211	0
	Co-ſine	Sine	Co tang.	Tangent	M

Degree 58.

Degree 32.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.724210	9.928420	9.795789	10.204211	60
1	9.724412	9.928341	9.796070	10.203930	59
2	9.724614	9.928262	9.796351	10.203649	58
3	9.724816	9.928183	9.796632	10.203368	57
4	9.725017	9.928104	9.796913	10.203087	56
5	9.725219	9.928025	9.797194	10.202806	55
6	9.725420	9.927946	9.797474	10.202522	54
7	9.725622	9.921867	9.797755	10.202245	53
8	9.725823	9.927787	9.798036	10.201964	52
9	9.726024	9.927708	9.798316	10.201684	51
10	9.726225	9.927628	9.798596	10.201404	50
11	9.726426	9.927549	9.798877	10.201123	49
12	9.726626	9.927469	9.799157	10.200843	48
13	9.726827	9.927390	9.799437	10.200563	47
14	9.727027	9.927310	9.799717	10.200283	46
15	9.727228	9.927231	9.799997	10.200003	45
16	9.727428	9.927151	9.800277	10.199723	44
17	9.727628	9.927071	9.800557	10.199443	43
18	9.727828	9.926991	9.800836	10.199163	42
19	9.728027	9.926911	9.801116	10.198884	41
20	9.728227	9.926831	9.801396	10.198604	40
21	9.728427	9.926751	9.801675	10.198325	39
22	9.728626	9.926641	9.801955	10.198045	38
23	9.728825	9.926591	9.802234	10.197766	37
24	9.729024	9.926511	9.802513	10.197487	36
25	9.729223	9.926431	9.802792	10.197207	35
26	9.729422	9.926351	9.803072	10.196928	34
27	9.729621	9.926270	9.803351	10.196649	33
28	9.729820	9.926190	9.803630	10.196370	32
29	9.730018	9.926110	9.803908	10.196091	31
30	9.730216	9.926029	9.804187	10.195813	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 57.

Degree 32.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.730216	9.926029	9.804187	10.195813	30
31	9.730415	9.925949	9.804466	10.195534	29
32	9.730613	9.925868	9.804745	10.195255	28
33	9.730811	9.925787	9.805023	10.194977	27
34	9.731009	9.925707	9.805302	10.194698	26
35	9.731206	9.925626	9.805580	10.194420	25
36	9.731404	9.925545	9.805859	10.194141	24
37	9.731601	9.925464	9.806137	10.193863	23
38	9.731799	9.925384	9.806415	10.193585	22
39	9.731996	9.925303	9.806693	10.193309	21
40	9.732193	9.925222	9.806971	10.193028	20
41	9.732390	9.925141	9.807249	10.192751	19
42	9.732587	9.925060	9.807527	10.192433	18
43	9.732784	9.924978	9.807805	10.192195	17
44	9.732980	9.924897	9.808083	10.191917	16
45	9.733177	9.924816	9.808361	10.191639	15
46	9.733373	9.924735	9.808638	10.191362	14
47	9.733569	9.924653	9.808916	10.191084	13
48	9.733765	9.924572	9.809193	10.190807	12
49	9.733961	9.924491	9.809471	10.190529	11
50	9.734157	9.924409	9.809748	10.190252	10
51	9.734353	9.924328	9.810025	10.189975	9
52	9.734548	9.924246	9.810302	10.189697	8
53	9.734744	9.924164	9.810580	10.189420	7
54	9.734939	9.924083	9.810857	10.189143	6
55	9.735134	9.924001	9.811134	10.188866	5
56	9.735330	9.923919	9.811410	10.188589	4
57	9.735525	9.923837	9.811687	10.188313	3
58	9.735719	9.923755	9.811964	10.188036	2
59	9.735914	9.923673	9.812241	10.187759	1
60	9.736109	9.923591	9.812517	10.187483	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 57.

Degree 33.

M	Sine	Co-sine	Tangen.	Co-tang.	
0	9.736109	9.923591	9.812517	10.187483	60
1	9.736309	9.923509	9.812794	10.187206	59
2	9.736497	9.923427	9.813070	10.186930	58
3	9.736692	9.923345	9.813347	10.186653	57
4	9.736886	9.923263	9.813623	10.186377	56
5	9.737080	9.923180	9.813899	10.186101	55
6	9.737274	9.923098	9.814175	10.185824	54
7	9.737467	9.923016	9.814452	10.185548	53
8	9.737661	9.922933	9.814728	10.185272	52
9	9.737854	9.922851	9.815004	10.184996	51
10	9.738048	9.922768	9.815279	10.184720	50
11	9.738241	9.922686	9.815555	10.184445	49
12	9.738434	9.922603	9.815831	10.184169	48
13	9.738627	9.922520	9.816107	10.183893	47
14	9.738820	9.922438	9.816382	10.183617	46
15	9.739013	9.922355	9.816658	10.183342	45
16	9.739205	9.922272	9.816933	10.183066	44
17	9.739398	9.922189	9.817209	10.182791	43
18	9.739590	9.922106	9.817484	10.182516	42
19	9.739783	9.922023	9.817759	10.182240	41
20	9.739975	9.921940	9.818035	10.181965	40
21	9.740167	9.921857	9.818310	10.181690	39
22	9.740359	9.921774	9.818585	10.181415	38
23	9.740550	9.921691	9.818860	10.181140	37
24	9.740742	9.921607	9.819135	10.180865	36
25	9.740934	9.921524	9.819410	10.180590	35
26	9.741125	9.921441	9.819684	10.180315	34
27	9.741316	9.921357	9.819959	10.180041	33
28	9.741507	9.921274	9.820234	10.179766	32
29	9.741698	9.921190	9.820508	10.179492	31
30	9.741889	9.921107	9.820783	10.179217	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 56.

Degree 33.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.741889	9.921107	9.820783	10.179217	30
31	9.742080	9.921023	9.821057	10.178943	29
32	9.742271	9.920939	9.821332	10.178668	28
33	9.742461	9.920855	9.821606	10.178394	27
34	9.742652	9.920772	9.821880	10.178120	26
35	9.742842	9.920688	9.822154	10.177846	25
36	9.743032	9.920604	9.822429	10.177571	24
37	9.743223	9.920520	9.822703	10.177297	23
38	9.743412	9.920436	9.822977	10.177023	22
39	9.743602	9.920352	9.823250	10.176739	21
40	9.743792	9.920268	9.823524	10.176476	20
41	9.743982	9.920184	9.823798	10.176202	19
42	9.744171	9.920099	9.824072	10.175928	18
43	9.744361	9.920015	9.824345	10.175655	17
44	9.744550	9.919931	9.824619	10.175381	16
45	9.744739	9.919846	9.824892	10.175108	15
46	9.744928	9.919762	9.825166	10.174834	14
47	9.745117	9.919677	9.825439	10.174560	13
48	9.745306	9.919593	9.825713	10.174287	12
49	9.745494	9.919508	9.825986	10.174014	11
50	9.745683	9.919424	9.826259	10.173741	10
51	9.745871	9.919339	9.826532	10.173468	9
52	9.746059	9.919254	9.826805	10.173195	8
53	9.746248	9.919169	9.827078	10.172922	7
54	9.746436	9.919084	9.827351	10.172649	6
55	9.746624	9.918999	9.827624	10.172376	5
56	9.746811	9.918915	9.827897	10.172103	4
57	9.746999	9.918830	9.828170	10.171830	3
58	9.747187	9.918744	9.828442	10.171558	2
59	9.747374	9.918659	9.828715	10.171285	1
60	9.747562	9.918574	9.828987	10.171012	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 56.

Degree 34.

M	Sine	*Co-sine*	Tangent	*Co-tang*	
0	9.747562	9.918574	9.828987	10.171012	60
1	9.747749	9.918489	9.829260	10.170740	59
2	9.747936	9.918404	9.829532	10.170468	58
3	9.748123	9.918318	9.829805	10.170195	57
4	9.748310	9.918233	9.830077	10.169923	56
5	9.748497	9.918147	9.830349	10.169651	55
6	9.748683	9.918062	9.830621	10.169379	54
7	9.748870	9.917976	9.830893	10.166106	53
8	9.749056	9.9 7891	9.831165	10.168834	52
9	9.749242	9.917805	9.831437	10.168563	51
10	9.749429	9.917719	9.831709	10.168291	50
11	9.749615	9.917634	9.831981	10.168019	49
12	9.749801	9.917548	9.832253	10.167747	48
13	9.749986	9.917462	9.832525	10.167475	47
14	9.750172	9.917376	9.832796	10.167204	46
15	9.750358	9.917290	9.833068	10.166932	45
16	9.750543	9.917204	9.833339	10.166660	44
17	9.750729	9.917118	9.833621	10.166389	43
18	9.750914	9.917032	9.833882	10.166118	42
19	9.751099	9.916945	9.834154	10.165846	41
20	9.751284	9.916859	9.834425	10.165575	40
21	9.751469	9.916773	9.834696	10.165304	39
22	9.751654	9.916686	9.834967	10.165033	38
23	9.751838	9.916600	9.835238	10.164762	37
24	9.752023	9.916514	9.835509	10.164491	36
25	9.752207	9.916427	9.835780	10.164220	35
26	9.752392	9.916340	9.836051	10.163949	34
27	9.752576	9.916254	9.836322	10.163678	33
28	9.752760	9.916167	9.836593	10.163407	32
29	9.752944	9.916080	9.836864	10.163136	31
30	9.753128	9.915994	9.837134	10.162866	30
	Co sine	Sine	*Co tang.*	Tangent	M

Degree 55.

Degree 34.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.753128	9.915994	9.837134	10.162866	30
31	9.753312	9.915907	9.837405	10.162595	29
32	9.753495	9.915820	9.837675	10.162325	28
33	9.753679	9.915733	9.837946	10.162054	27
34	9.753862	9.915646	9.838216	10.161784	26
35	9.754046	9.915559	9.838487	10.161513	25
36	9.754229	9.915472	9.838757	10.161243	24
37	9.754412	9.915385	9.839027	10.160973	23
38	9.754595	9.915297	9.839297	10.160702	22
39	9.754778	9.915210	9.839568	10.160432	21
40	9.754960	9.915123	9.839838	10.160162	20
41	9.755143	9.915035	9.840108	10.159892	19
42	9.755325	9.914948	9.840378	10.159622	18
43	9.755508	9.914860	9.840647	10.159352	17
44	9.755690	9.914773	9.840917	10.159083	16
45	9.755872	9.914685	9.841187	10.158813	15
46	9.756054	9.914597	9.841457	10.158543	14
47	9.756236	9.914510	9.841726	10.158273	13
48	9.756418	9.914422	9.841996	10.158004	12
49	9.756600	9.914334	9.842266	10.157734	11
50	9.756781	9.914246	9.842535	10.157465	10
51	9.756963	9.914158	9.842804	10.157195	9
52	9.757144	9.914070	9.843074	10.156926	8
53	9.757326	9.913982	9.843343	10.156657	7
54	9.757507	9.913894	9.843612	10.156387	6
55	9.757688	9.913806	9.843882	10.156118	5
56	9.757869	9.913718	9.844151	10.155849	4
57	9.758049	9.913630	9.844420	10.155580	3
58	9.758230	9.913541	9.844689	10.155311	2
59	9.758411	9.913453	9.844958	10.155042	1
60	9.758591	9.913364	9.845227	10.154773	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 55.

Degree 35.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.758591	9.913364	9.845227	10.154774	60
1	9.758772	9.913276	9.845496	10.154504	59
2	9.758952	9.913187	9.845764	10.154235	58
3	9.759132	9.913099	9.846033	10.153967	57
4	9.759312	9.913010	9.846302	10.153698	56
5	9.759492	9.912921	9.846570	10.153429	55
6	9.759672	9.912833	9.846839	10.153161	54
7	9.759851	9.912744	9.847107	10.152892	53
8	9.760031	9.912655	9.847376	10.152624	52
9	9.760210	9.912566	9.847644	10.152356	51
10	9.760390	9.912477	9.847913	10.152087	50
11	9.760569	9.912388	9.848181	10.151819	49
12	9.760748	9.912299	9.848449	10.151551	48
13	9.760927	9 912210	9.848717	10.151283	47
14	9.761106	9.912121	9.848985	10.151015	46
15	9.761285	9.912031	9.849254	10.150746	45
16	9.761464	9.911942	9.849522	10.150478	44
17	9.761642	9.911853	9.849789	10.150214	43
18	9.761821	9.911763	9.850057	10.149943	42
19	9.761999	9.911674	9.850325	10.149675	41
20	9.762177	9.911584	9.850593	10.149407	40
21	9.762356	9.911495	9.850861	10.149139	39
22	9.762534	9.911405	9.851128	10.148872	38
23	9.762712	9.911315	9.851396	10.148604	37
24	9.762889	9.911226	9.351664	10.148336	36
25	9.763067	9.911136	9.851931	10.148069	35
26	9.763245	9.911046	9.852199	10.147801	34
27	9.763422	9.910956	9.852466	10.147534	33
28	9.763599	9.910866	9.852731	10.147267	32
29	9.763777	9.910776	9.853001	10.146999	31
30	9.763954	9.910686	9.853268	10.146732	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 54.

Degree 35.

M	Sine	Co sine	Tangen.	Co tang.	
30	9.763954	9.910686	9.853268	10.146732	30
31	9.764131	9.910596	9.853532	10.146465	29
32	9.764308	9.910506	9.853802	10.146198	28
33	9.764485	9.910415	9.854069	10.145930	27
34	9.764662	9.910325	9.854336	10.145664	26
35	9.764828	9.910235	9.854603	10.145397	25
36	9.765015	9.910144	9.854870	10.145130	24
37	9.765191	9.910054	9.855137	10.144863	23
38	9.765367	9.909963	9.855404	10.144596	22
39	9.765544	9.909873	9.855671	10.144329	21
40	9.765720	9.909782	9.855937	10.144063	20
41	9.765896	9.909691	9.856204	10.143796	19
42	9.766071	9.909601	9.856471	10.143529	18
43	9.766247	9.909510	9.856737	10.143263	17
44	9.766423	9.909419	9.857004	10.142996	16
45	9.766598	9.909328	9.857270	10.142730	15
46	9.766774	9.909237	9.857537	10.142463	14
47	9.766949	9.909146	9.857803	10.142197	13
48	9.767124	9.909055	9.858069	10.141931	12
49	9.767299	9.908964	9.858336	10.141664	11
50	9.767474	9.908873	9.858602	10.141398	10
51	9.767649	9.908781	9.858868	10.141132	9
52	9.767824	9.908690	9.859134	10.140856	8
53	9.767997	9.908599	9.859400	10.140600	7
54	9.768173	9.908507	9.859666	10.140334	6
55	9.768348	9.908416	9.859932	10.140068	5
56	9.768522	9.908324	9.860198	10.139802	4
57	9.768696	9.908233	9.860464	10.139536	3
58	9.768871	9.908141	9.86073[illegible]	10.139270	2
59	9.769045	9.908049	9.860995	10.139005	1
60	9.769219	9.907958	9.861261	10.138739	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 54.

Degree 36.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.769219	9.907958	9.861261	10.138739	60
1	9.769392	9.907866	9.861527	10.138473	59
2	9.769566	9.907774	9.861792	10.138208	58
3	9.769740	9.907682	9.862058	10.137942	57
4	9.769913	9.907590	9.862323	10.137677	56
5	9.770087	9.907498	9.862589	10.137411	55
6	9.770260	9.907406	9.862854	10.137146	54
7	9.770433	9.907314	9.863119	10.136880	53
8	9.770606	9.907221	9.863385	10.136615	52
9	9.770779	9.907129	9.863650	10.136350	51
10	9.770952	9.907037	9.863915	10.136085	50
11	9.771125	9.906945	9.864180	10.135820	49
12	9.771298	9.906852	9.864445	10.135554	48
13	9.771470	9.906760	9.864710	10.135289	47
14	9.771643	9.906667	9.864975	10.135024	46
15	9.771815	9.906574	9.865240	10.134759	45
16	9.771987	9.906482	9.865505	10.134495	44
17	9.772159	9.906389	9.865770	10.134230	43
18	9.772331	9.906296	9.866035	10.133965	42
19	9.772503	9.906203	9.866300	10.133700	41
20	9.772675	9.906111	9.866564	10.133436	40
21	9.772847	9.906018	9.866829	10.133171	39
22	9.773018	9.905925	9.867094	10.132906	38
23	9.773190	9.905832	9.867358	10.132642	37
24	9.773361	9.905738	9.867623	10.132377	36
25	9.773533	9.905645	9.867887	10.132113	35
26	9.773704	9.905552	9.868152	10.131848	34
27	9.773875	9.905459	9.868416	10.131584	33
28	9.774046	9.905365	9.868680	10.131320	32
29	9.774217	9.905272	9.868945	10.131055	31
30	9.774388	9.905179	9.869209	10.130791	30
	Co-sine	Sine	Co-tang	Tangent	M

Degree 53.

Degree 36.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.774388	9.905179	9.869209	10.130791	30
31	9.774558	9.905085	9.864773	10.130527	29
32	9.774729	9.904992	9.867337	10.130263	28
33	9.774899	9.904898	9.870001	10.129999	27
34	9.775070	9.904804	9.870265	10.129735	26
35	9.775240	9.904711	9.870529	10.129471	25
36	9.775410	9.904617	9.870793	10.129207	24
37	9.775580	9.904523	9.871057	10.128943	23
38	9.775750	9.904429	9.871321	10.128679	22
39	9.775920	9.904335	9.871585	10.128415	21
40	9.776090	9.904241	9. 71849	10.128151	20
41	9.776259	9.904147	9.872112	10.127888	19
42	9.776429	9.904053	9.872376	10.127624	18
43	9.776598	9.903959	9.872640	10.127360	17
44	9.776768	9.903864	9.872903	10.127097	16
45	9.776937	9.903770	9.873167	10.126833	15
46	9.777106	9.903676	9.873430	10.126570	14
47	9.777275	9.903581	9.873694	10.126306	13
48	9.777444	9.903486	9.873957	10.126043	12
49	9.777613	9.903392	9.874220	10.125780	11
50	9.777781	9.903298	9.874484	10.125516	10
51	9.777950	9.903203	9.874747	10.125253	9
52	9.778119	9.903108	9.875010	10.124990	8
53	9.778287	9.903013	9.875273	10.124727	7
54	9.778455	9.902919	9.875536	10.124464	6
55	9.778623	9.902824	9.875799	10.124201	5
56	9.778792	9.902729	9.876063	10.123937	4
57	9.778960	9.902634	9.876326	10.123674	3
58	9.779129	9.902539	9.876589	10.123411	2
59	9.779295	9.902444	9.876851	10.123149	1
60	9.779463	9.902349	9.877114	10.122886	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 53.

Degree 37.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.779463	9.902349	9.877114	10.122885	60
1	9.779631	9.902253	9.877377	10.122623	59
2	9.779798	9.902158	9.877640	10.122360	58
3	9.779965	9.902063	9.877903	10.122097	57
4	9.780133	9.901967	9.878165	10.121834	56
5	9.780300	9.901872	9.878428	10.121572	55
6	9.780467	9.901776	9.878691	10.121309	54
7	9.780634	9.901681	9.878953	10.121047	53
8	9.780801	9.901585	9.879216	10.120784	52
9	9.780968	9.901488	9.879478	10.120522	51
10	9.781134	9.901391	9.879741	10.120259	50
11	9.781301	9.901298	9.880003	10.119997	49
12	9.781467	9.901202	9.880265	10.119734	48
13	9.781634	9.901106	9.880528	10.119472	47
14	9.781800	9.901010	9.880790	10.119210	46
15	9.781966	9.900914	9.881052	10.118948	45
16	9.782132	9.900828	9.881314	10.118686	44
17	9.782298	9.900722	9.881576	10.118424	43
18	9.782464	9.900626	9.881839	10.118161	42
19	9.782690	9.900529	9.882101	10.117899	41
20	9.782796	9.900433	9.882363	10.117637	40
21	9.782961	9.900337	9.882625	10.117375	39
22	9.783127	9.900240	9.882886	10.117114	38
23	9.783292	9.900144	9.883148	10.116852	37
24	9.783457	9.900047	9.883410	10.116590	36
25	9.783623	9.899951	9.883672	10.116328	35
26	9.783788	9.899854	9.883934	10.116066	34
27	9.783953	9.899757	9.884195	10.115805	33
28	9.784118	9.899660	9.884457	10.115543	32
29	9.784282	9.899563	9.884719	10.115281	31
30	9.784447	9.899467	9.884980	10.115020	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 52.

Degree 37.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.784447	9.899467	9.884980	10.115025	30
31	9.784616	9.899370	9.885242	10.114758	29
32	9.784776	9.899273	9.885503	10.114497	28
33	9.784941	9.899175	9.885765	10.114235	27
34	9.785105	9.899078	9.886026	10.113974	26
35	9.785269	9.898981	9.886288	10.113712	25
36	9.785433	9.898884	9.886549	10.113451	24
37	9.785591	9.898787	9.886810	10.113190	23
38	9.785761	9.898689	9.887072	10.112928	22
39	9.785925	9.898592	9.887333	10.112667	21
40	9.786088	9.898494	9.887594	10.112406	20
41	9.786252	9.898397	9.887855	10.112145	19
42	9.786416	9.898299	9.888116	10.111884	18
43	9.786579	9.898201	9.888377	10.111623	17
44	9.786742	9.898104	9.888638	10.111362	16
45	9.786909	9.898006	9.888899	10.111101	15
46	9.787069	9.897908	9.889160	10.110840	14
47	9.787232	9.897810	9.889421	10.110579	13
48	9.787395	9.897112	9.889682	10.110318	12
49	9.787557	9.897614	9.889943	10.110057	11
50	9.787720	9.897516	9.890204	10.109796	10
51	9.787883	9.897418	9.890465	10.109535	9
52	9.788045	9.897320	9.890725	10.109275	8
53	9.788208	9.897222	9.890986	10.109014	7
54	9.788370	9.897123	9.891248	10.108753	6
55	9.788532	9.897025	9.891507	10.108493	5
56	9.788694	9.896926	9.891768	10.108232	4
57	9.788856	9.896828	9.892028	10.107972	3
58	9.789018	9.896729	9.892289	10.107711	2
59	9.789180	9.896631	9.892549	10.107451	1
60	9.789342	9.896532	9.892810	10.107190	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 52.

Degree 38.

M	Sine	Co sine	Tangent	Co-tang.	
0	9.789342	9.896532	9.892810	10.107190	60
1	9.789504	9.896433	9.893070	10.106930	59
2	9.789665	9.896335	9.893330	10.106669	58
3	9.789827	9.896236	9.893591	10.106409	57
4	9.789988	9.896137	9.893851	10.106149	56
5	9.790149	9.896038	9.894111	10.105889	55
6	9.790310	9.895939	9.894371	10.105628	54
7	9.790471	9.895840	9.894632	10.105368	53
8	9.790632	9.895741	9.894892	10.105108	52
9	9.790793	9.895641	9.895152	10.104848	51
10	9.790954	9.895542	9.895412	10.104588	50
11	9.791115	9.895443	9.895672	10.104328	49
12	9.791275	9.895343	9.895932	10.104068	48
13	9.791436	9.895244	9.896192	10.103808	47
14	9.791596	9.895144	9.896452	10.103548	46
15	9.791756	9.895045	9.896712	10.103288	45
16	9.791917	9.894945	9.896971	10.103028	44
17	9.792077	9.894846	9.897231	10.102769	43
18	9.792237	9.894746	9.897491	10.102509	42
19	9.792397	9.894646	9.897751	10.102249	41
20	9.792557	9.894546	9.898010	10.101990	40
21	9.792716	9.894446	9.898270	10.101730	39
22	9.792876	9.894346	9.898530	10.101470	38
23	9.793035	9.894246	9.898789	10.101211	37
24	9.793195	9.894146	9.899049	10.100951	36
25	9.793354	9.894046	9.899308	10.100692	35
26	9.793513	9.893946	9.899568	10.100432	34
27	9.793673	9.893845	9.899827	10.100173	33
28	9.793832	9.893745	9.900086	10.099913	32
29	9.793991	9.893645	9.900346	10.099654	31
30	9.794149	9.893544	9.900605	10.099395	30
	Co sine	Sine	Co-tang	Tangent	M

Degree 51.

Degree 38.

M	Sine	Co-*sine*	Tangent	Co-*tang.*	
30	9.794149	9.893544	9.900605	10.099395	30
31	9.794308	9.893444	9.900864	10.099135	29
32	9.794467	9.893343	9.901124	10.098876	28
33	9.794626	9.893243	9.901383	10.098617	27
34	9.794784	9.893142	9.901642	10.098358	26
35	9.794942	9.893041	9.901901	10.098099	25
36	9.795101	9.892940	9.902160	10.097839	24
37	9.795259	9.892839	9.902419	10.097580	23
38	9.795417	9.892738	9.902678	10.097321	22
39	9.795575	9.892637	9.902937	10.097062	21
40	9.795733	9.892536	9.903196	10.096803	20
41	9.795891	9.892435	9.903455	10.096544	19
42	9.796049	9.892334	9.903714	10.096285	18
43	9.796206	9.892233	9.903973	10.096027	17
44	9.796364	9.892132	9.904232	10.095768	16
45	9.796521	9.892030	9.904491	10.095509	15
46	9.796678	9.891929	9.904750	10.095250	14
47	9.796836	9.891827	9.905008	10.094991	13
48	9.796993	9.891726	9.905267	10.094733	12
49	9.797150	9.891624	9.905526	10.094474	11
50	9.797307	9.891522	9.905784	10.094215	10
51	9.797464	9.891421	9.906043	10.093957	9
52	9.797621	9.891319	9.906302	10.093698	8
53	9.797777	9.891217	9.906560	10.093440	7
54	9.797934	9.891115	9.906819	10.093181	6
55	9.798091	9.891013	9.907077	10.092923	5
56	9.798247	9.890911	9.907336	10.092664	4
57	9.798403	9.890809	9.907594	10.092406	3
58	9.798560	9.890707	9.907852	10.092147	2
59	9.798716	9.890605	9.908111	10.091889	1
60	9.798872	9.890503	9.908369	10.091631	0
	Co-sine	Sine	*Co tang.*	Tangent	M

Degree 51.

Degree 39.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.798872	9.890503	9.908369	10.091631	60
1	9.799028	9.890400	9.908627	10.091373	59
2	9.799184	9.890298	9.908886	10.091114	58
3	9.799339	9.890195	9.909144	10.090856	57
4	9.799495	9.890093	9.909402	10.090598	56
5	9.799651	9.889990	9.909660	10.090340	55
6	9.799806	9.889888	9.909918	10.090081	54
7	9.799961	9.889785	9.910176	10.089823	53
8	9.800117	9.889682	9.910435	10.089565	52
9	9.800272	9.889579	9.910693	10.089307	51
10	9.800427	9.889476	9.910951	10.089049	50
11	9.800582	9.889374	9.911209	10.088791	49
12	9.800737	9.889271	9.911467	10.088533	48
13	9.800892	9.889167	9.911724	10.088275	47
14	9.801047	9.889064	9.911982	10.088017	46
15	9.801201	9.888961	9.912240	10.087760	45
16	9.801356	9.888858	9.912498	10.087502	44
17	9.801510	9.888755	9.912756	10.087244	43
18	9.801665	9.888651	9.913014	10.086986	42
19	9.801819	9.888548	9.913271	10.086729	41
20	9.801973	9.888444	9.913529	10.086471	40
21	9.802127	9.888341	9.913787	10.086213	39
22	9.802282	9.888237	9.914044	10.085956	38
23	9.802435	9.888133	9.914302	10.085698	37
24	9.802589	9.888030	9.914560	10.085440	36
25	9.802743	9.887926	9.914817	10.085183	35
26	9.802897	9.887822	9.915075	10.084925	34
27	9.803050	9.887718	9.915332	10.084668	33
28	9.803204	9.887614	9.915590	10.084410	32
29	9.803357	9.887510	9.915847	10.084153	31
30	9.803510	9.887406	9.916104	10.083895	30
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 50.

Degree 39.

M	Sine	Co-sine	Tangen.	Co-tang.	
30	9.803510	9.887406	9.916104	10.083895	30
31	9.803664	9.887302	9.916362	10.083638	29
32	9.803817	9.887198	9.916619	10.083381	28
33	9.803970	9.887093	9.916876	10.083123	27
34	9.804123	9.887989	9.917134	10.082866	26
35	9.804276	9.886884	9.917391	10.082609	25
36	9.804428	9.886780	9.917648	10.082352	24
37	9.804581	9.886675	9.917905	10.082094	23
38	9.804734	9.886571	9.918162	10.081837	22
39	9.804886	9.886466	9.918420	10.081580	21
40	9.805038	9.886361	9.918677	10.081323	20
41	9.805191	9.886257	9.918934	10.081066	19
42	9.805343	9.886152	9.919191	10.080809	18
43	9.805495	9.886047	9.919448	10.080552	17
44	9.805647	9.885942	9.919705	10.080295	16
45	9.805799	9.885837	9.919962	10.080038	15
46	9.805951	9.885732	9.920219	10.079781	14
47	9.806103	9.885627	9.920476	10.079524	13
48	9.806254	9.885521	9.920733	10.079267	12
49	9.806406	9.885416	9.920990	10.079010	11
50	9.806557	9.885311	9.921247	10.078753	10
51	9.806709	9.885205	9.921503	10.078496	9
52	9.806860	9.885100	9.921760	10.078240	8
53	9.807011	9.884994	9.922017	10.077983	7
54	9.807162	9.884889	9.922274	10.077726	6
55	9.807314	9.884783	9.922530	10.077469	5
56	9.807464	9.884677	9.922787	10.077213	4
57	9.807615	9.884572	9.923044	10.076956	3
58	9.807766	9.884466	9.923300	10.076699	2
59	9.807917	9.884360	9.923557	10.076443	1
60	9.808067	9.884254	9.923813	10.076186	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 50.

Degree 39.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.80806	9.884254	9.923813	10.076186	60
1	9.808218	9.884148	9.924070	10.075930	59
2	9.808368	9.884042	9.924327	10.075673	58
3	9.808519	9.883936	9.924583	10.075417	57
4	9.808669	9.883829	9.924839	10.075160	56
5	9.808819	9.883723	9.925096	10.074904	55
6	9.808969	9.883617	9.925352	10.074647	54
7	9.809119	9.883510	9.925609	10.074391	53
8	9.809269	9.883404	9.925865	10.074135	52
9	9.809419	9.883297	9.926121	10.073878	51
10	9.809569	9.883191	9.926378	10.073622	50
11	9.809718	9.883084	9.926634	10.073366	49
12	9.809868	9.882977	9.926890	10.073110	48
13	9.810017	9.882871	9.927147	10.072853	47
14	9.810166	9.882764	9.927403	10.072597	46
15	9.810316	9.882657	9.927659	10.072341	45
16	9.810465	9.882550	9.927915	10.072085	44
17	9.810614	9.882443	9.928171	10.071829	43
18	9.810763	9.882336	9.928427	10.071573	42
19	9.810912	9.882228	9.928683	10.071317	41
20	9.810061	9.882121	9.928940	10.071060	40
21	9.811210	9.882014	9.929196	10.070804	39
22	9.811358	9.881907	9.929452	10.070548	38
23	9.811506	9.881799	9.929708	10.070292	37
24	9.811655	9.881692	9.929964	10.070036	36
25	9.811804	9.881584	9.930219	10.069781	35
26	9.811952	9.881477	9.930475	10.069525	34
27	9.812100	9.881369	9.930731	10.069269	33
28	9.812248	9.881261	9.930987	10.069013	32
29	9.812396	9.881153	9.931243	10.068757	31
30	9.812544	9.881045	9.931499	10.068501	30
	Co sine	Sine	Co tang	Tangent	M

Degree 55.

Degree 40.

M	Sine	Co-sine	Tangen	Co-tang.	
30	9.812544	9.881045	9.931499	10.068501	30
31	9.812692	9.880937	9.931755	10.068245	29
32	9.812840	9.880829	9.932010	10.067989	28
33	9.812988	9.880721	9.932266	10.067734	27
34	9.813135	9.880613	9.932522	10.067478	26
35	9.813283	9.880505	9.932778	10.067222	25
36	9.813430	9.880397	9.933033	10.066967	24
37	9.813578	9.880289	9.933289	10.066711	23
38	9.813725	9.880180	9.933545	10.066455	2
39	9.81387[illegible]	9.880072	9.933800	10.066200	21
40	9.814019	9.879963	9.934056	10.065944	20
41	9.814166	9.879855	9.934311	10.065688	19
42	9.814313	9.879746	9.934567	10.065433	18
43	9.814460	9.879637	9.934822	10.065177	17
44	9.814607	9.879529	9.935078	10.064922	1
45	9.814753	9.879420	9.935333	10.064666	15
46	9.814900	9.879311	9.935589	10.064411	14
47	9.815046	9.879202	9.935844	10.064156	13
48	9.815193	9.879093	9.936100	10.063900	12
49	9.815339	9.878984	9.936355	10.063645	11
50	9.815485	9.878875	9.936610	10.063389	10
51	9.815631	9.878766	9.936866	10.063134	9
52	9.815777	9.878656	9.937121	10.062879	8
53	9.815923	9.878547	9.937376	10.062623	7
54	9.816069	9.878438	9.937632	10.062368	6
55	9.816215	9.878328	9.937887	10.062113	5
56	9.816361	9.878219	9.938142	10.061858	4
57	9.816506	9.878109	9.938397	10.061602	3
58	9.816652	9.877999	9.938653	10.061347	2
59	9.816797	9.877890	9.938908	10.061092	1
60	9.816943	9.877780	9.939163	10.060837	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 49.

Degree 41.

M	Sine	Co-sine	Tangen.	Co-tang.	
0	9.816943	9.877780	9.939163	10.060837	60
1	9.817088	9.877670	9.939418	10.060582	59
2	9.817233	9.877560	9.939673	10.060327	58
3	9.817378	9.877450	9.939928	10.060072	57
4	9.817523	9.877340	9.940183	10.059816	56
5	9.817668	9.877230	9.940438	10.059562	55
6	9.817813	9.877120	9.940693	10.059307	54
7	9.817958	9.877009	9.940948	10.059052	53
8	9.818103	9.876899	9.941203	10.058797	52
9	9.818247	9.876789	9.941458	10.058542	51
10	9.818392	9.876678	9.941713	10.058287	50
11	9.818536	9.876568	9.941968	10.058032	49
12	9.818681	9.876457	9.942223	10.057777	48
13	9.818825	9.876347	9.942478	10.057522	47
14	9.818969	9.876236	9.942733	10.057267	46
15	9.818113	9.876125	9.942988	10.057012	45
16	9.819257	9.876014	9.943243	10.056757	44
17	9.819401	9.875904	9.943498	10.056502	43
18	9.819545	9.875793	9.943752	10.056248	42
19	9.819689	9.875682	9.944007	10.055993	41
20	9.819832	9.875571	9.944262	10.055738	40
21	9.819976	9.875459	9.944517	10.055483	39
22	9.820119	9.875348	9.944771	10.055229	38
23	9.820263	9.875237	9.945026	10.054974	37
24	9.820406	9.875125	9.945281	10.054719	36
25	9.820549	9.875014	9.945535	10.054464	35
26	9.820693	9.874903	9.945790	10.054210	34
27	9.820836	9.874791	9.946045	10.053955	33
28	9.820979	9.874679	9.946299	10.053701	32
29	9.821122	9.874568	9.946554	10.053446	31
30	9.821264	9.874456	9.946808	10.053192	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 48.

Degree 41

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
30	9.821264	9.874456	9.946808	10.053192	30
31	9.821407	9.874344	9.947063	10.052937	29
32	9.821550	9.874232	9.947317	10.052682	28
33	9.821692	9.874120	9.947572	10.052428	27
34	9.821835	9.874008	9.947826	10.052173	26
35	9.821977	9.873896	9.948081	10.051919	25
36	9.822120	9.873784	9.948335	10.051664	24
37	9.822262	9.873672	9.948590	10.051410	23
38	9.822404	9.873560	9.948844	10.051156	22
39	9.822546	9.873447	9.949099	10.050901	21
40	9.822688	9.873335	9.949353	10.050647	20
41	9.822830	9.873223	9.949607	10.050393	19
42	9.822972	9.873110	9.949862	10.050138	18
43	9.823114	9.872998	9.950116	10.049884	17
44	9.823255	9.872885	9.950370	10.049630	16
45	9.823397	9.872772	9.950625	10.049375	15
46	9.823538	9.872659	9.950879	10.049121	14
47	9.823680	9.872546	9.951133	10.048867	13
48	9.823821	9.872434	9.951388	10.048612	12
49	9.823962	9.872321	9.951642	10.048358	11
50	9.824104	9.872208	9.951896	10.048104	10
51	9.824245	9.872094	9.952150	10.047850	9
52	9.824386	9.871981	9.952404	10.047575	8
53	9.824527	9.871868	9.952659	10.047341	7
54	9.824667	9.871755	9.952913	10.047087	6
55	9.824808	9.871641	9.953167	10.046833	5
56	9.824949	9.871528	9.953421	10.046579	4
57	9.825090	9.871414	9.953675	10.046325	3
58	9.825230	9.871301	9.953929	10.046071	2
59	9.825370	9.871187	9.954183	10.045817	1
60	9.825511	9.871073	9.954437	10.045563	0
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 48.

Degree 42.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.825511	9.871073	9.954437	10.045563	60
1	9.825651	9.870960	9.954691	10.045308	59
2	9.825791	9.870846	9.954945	10.045054	58
3	9.825931	9.870732	9.955199	10.044800	57
4	9.826071	9.870618	9.955453	10.044546	56
5	9.826211	9.870504	9.955707	10.044292	55
6	9.826351	9.870390	9.955961	10.044038	54
7	9.826491	9.870275	9.956215	10.043784	53
8	9.826631	9.870161	9.956469	10.043531	52
9	9.826770	9.870047	9.956723	10.043276	51
10	9.826910	9.869933	9.956977	10.043023	50
11	9.827049	9.869818	9.957231	10.042769	49
12	9.827189	9.869704	9.957485	10.042515	48
13	9.827328	9.869589	9.957739	10.042261	47
14	9.827467	9.869474	9.957993	10.042007	46
15	9.827606	9.869360	9.958246	10.041753	45
16	9.827745	9.869245	9.958500	10.041500	44
17	9.827884	9.869130	9.958754	10.041246	43
18	9.828023	9.869015	9.959008	10.040992	42
19	9.828162	9.868900	9.959262	10.040738	41
20	9.828301	9.868785	9.959515	10.040485	40
21	9.828439	9.868670	9.959769	10.040231	39
22	9.828578	9.868555	9.960023	10.039977	38
23	9.828716	9.868439	9.960277	10.039723	37
24	9.828855	9.868324	9.960530	10.039469	36
25	9.828993	9.868209	9.960784	10.039216	35
26	9.829131	9.868093	9.961038	10.038962	34
27	9.829269	9.867978	9.961291	10.038608	33
28	9.829407	9.867862	9.961545	10.038451	32
29	9.829545	9.867747	9.961799	10.038201	31
30	9.829683	9.867631	9.962052	10.037947	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 47.

Degree 42.

M	Sine	Co-sine	Tangent	Co-tang	
30	9.829683	9.867631	9.962052	10.037947	30
31	9.829821	9.867515	9.962306	10.037694	29
32	9.829959	9.867399	9.962560	10.037440	28
33	9.830096	9.867283	9.962813	10.037187	27
34	9.830234	9.867167	9.963067	10.036933	26
35	9.830372	9.867051	9.963320	10.036680	25
36	9.830509	9.866935	9.963574	10.036426	24
37	9.830646	9.866819	9.963827	10.036173	23
38	9.830784	9.866703	9.964081	10.035919	22
39	9.830921	9.866586	9.964335	10.035665	21
40	9.831058	9.866470	9.964588	10.035412	20
41	9.831195	9.866353	9.964842	10.035158	19
42	9.831332	9.866237	9.965095	10.034905	18
43	9.831469	9.866120	9.965348	10.034652	17
44	9.831606	9.866004	9.965602	10.034398	16
45	9.831742	9.865887	9.965855	10.034144	15
46	9.831879	9.865770	9.966109	10.033891	14
47	9.832015	9.865653	9.966362	10.033638	13
48	9.832152	9.865536	9.966616	10.033384	12
49	9.832288	9.865419	9.966869	10.033131	11
50	9.832425	9.865302	9.967122	10.032878	10
51	9.832561	9.865185	9.967376	10.032624	9
52	9.832697	9.865068	9.967629	10.032371	8
53	9.832833	9.864950	9.967883	10.032117	7
54	9.832969	9.864833	9.968136	10.031864	6
55	9.833105	9.864716	9.968389	10.031611	5
56	9.833241	9.864598	9.968643	10.031357	4
57	9.833376	9.864480	9.968896	10.031104	3
58	9.833512	9.864363	9.969149	10.030851	2
59	9.833648	9.864245	9.969403	10.030597	1
60	9.833783	9.864127	9.969656	10.030344	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 47.

Degree 43.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	9.833783	9.864127	9.969656	10.030344	60
1	9.833919	9.864010	9.969909	10.030091	59
2	9.834054	9.863892	9.970162	10.029838	58
3	9.834189	9.863774	9.970416	10.029584	57
4	9.834324	9.863656	9.970669	10.029331	56
5	9.834460	9.863537	9.970922	10.029078	55
6	9.834595	9.863419	9.971175	10.028827	54
7	9.834730	9.863301	9.971428	10.028571	53
8	9.834865	9.863183	9.971682	10.028318	52
9	9.834999	9.863064	9.971935	10.028065	51
10	9.835134	9.862946	9.972188	10.027812	50
11	9.835269	9.862827	9.972441	10.027559	49
12	9.835503	9.862709	9.972694	10.027306	48
13	9.835538	9.862590	9.972948	10.027052	47
14	9.835672	9.862471	9.973201	10.026799	46
15	9.835806	9.862353	9.973454	10.026546	45
16	9.835941	9.862234	9.973707	10.026293	44
17	9.836075	9.862115	9.973960	10.026040	43
18	9.836209	9.861996	9.974213	10.025787	42
19	9.836343	9.861877	9.974466	10.025534	41
20	9.836477	9.861757	9.974719	10.025280	40
21	9.836611	9.861638	9.974973	10.025027	39
22	9.836745	9.861519	9.975229	10.024774	38
23	9.836878	9.861399	9.975479	10.024521	37
24	9.837012	9.861280	9.975732	10.024268	36
25	9.837146	9.861161	9.975985	10.024015	35
26	9.837279	9.861041	9.976238	10.023762	34
27	9.837412	9.860921	9.976491	10.023509	33
28	9.837546	9.860802	9.976744	10.023256	32
29	9.837679	9.860682	9.976997	10.023003	31
30	9.837812	9.860562	9.977250	10.022750	30
	Co-sine	Sine	*Co tang.*	Tangent	M

Degree 46.

Degree 43.

M	Sine	Co sine	Tangent	Co-tang.	
30	9.837812	9.860562	9.977250	10.022750	30
31	9.837945	9.860442	9.977503	10.022497	29
32	9.838078	9.860322	9.977756	10.022244	28
33	9.838211	9.860202	9.978009	10.021991	27
34	9.838344	9.860082	9.978262	10.021738	26
35	9.838477	9.859962	9.978515	10.021485	25
36	9.838609	9.859842	9.978768	10.021232	24
37	9.838742	9.859721	9.979021	10.020979	23
38	9.838875	9.859601	9.979274	10.020726	22
39	9.839007	9.859480	9.979527	10.020473	21
40	9.839140	9.859360	9.979780	10.020220	20
41	9.839272	9.859239	9.980033	10.019967	19
42	9.839484	9.859118	9.980285	10.019714	18
43	9.839536	9.858998	9.980538	10.019461	17
44	9.839668	9.858877	9.980791	10.019209	16
45	9.839800	9.858756	9.981044	10.018956	15
46	9.839932	9.858639	9.981297	10.018703	14
47	9.840064	9.858514	9.981550	10.018450	13
48	9.840196	9.858398	9.981803	10.018197	12
49	9.840428	9.858272	9.982056	10.017944	11
50	9.840459	9 858150	9.982309	10.01769	10
51	9.840591	9.858029	9.982562	10.017438	9
52	9.840722	9.857908	9.982814	10.017185	8
53	9.840854	9.857785	9.983067	10.016933	7
54	9.840935	9.8 7665	9.983320	10.01668	6
55	9.841116	9.857543	9.983573	10.016427	5
56	9.841247	9.857421	9.983826	10.016174	4
57	9.841378	9.857300	9.984079	10.015921	3
58	9.841509	9.857173	9 984331	10.015668	2
59	9.841640	9.857056	9.984584	10.015416	1
60	9.841771	9.856934	9.984837	10.015163	0
	Co sine	Sine	Co-tang.	Tangent	M

Degree 46.

Degree 44.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.841771	9.856934	9.984837	10.015162	60
1	9.841902	9.856812	9.985090	10.014910	59
2	9.842033	9.856690	9.985343	10.014657	58
3	9.842163	9.856568	9.985596	10.014404	57
4	9.842294	9.856445	9.985848	10.014152	56
5	9.842424	9.856323	9.986101	10.013899	55
6	9.842555	9.856201	9.986354	10.013646	54
7	9.842685	9.856078	9.986607	10.013393	53
8	9.842815	9.855955	9.986859	10.013141	52
9	9.842945	9.855833	9.987112	10.012888	51
10	9.843076	9.855710	9.987365	10.012635	50
11	9.843206	9.855588	9.987618	10.012382	49
12	9.843336	9.855465	9.987871	10.012129	48
13	9.843465	9.855342	9.988123	10.011877	47
14	9.843595	9.855219	9.988376	10.011624	46
15	9.843725	9.855096	9.988629	10.011371	45
16	9.843855	9.854973	9.988882	10.011118	44
17	9.843984	9.854850	9.989134	10.010866	43
18	9.844114	9.854727	9.989387	10.010613	42
19	9.844243	9.854603	9.989640	10.010360	41
20	9.844372	9.854480	9.989893	10.010107	40
21	9.844502	9.854356	9.990145	10.009855	39
22	9.844631	9.854233	9.990398	10.009602	38
23	9.844760	9.854109	9.990651	10.009349	37
24	9.844889	9.853986	9.990903	10.009097	36
25	9.845018	9.853862	9.991156	10.008844	35
26	9.845147	9.853738	9.991409	10.008591	34
27	9.845276	9.853614	9.991662	10.008338	33
28	9.845404	9.853490	9.991914	10.008086	32
29	9.845533	9.853366	9.992167	10.007833	31
30	9.845662	9.853242	9.992420	10.007580	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 45.

Degree 44.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.845662	9.853242	9.992420	10.007580	30
31	9.845790	9.853118	9.992672	10.007328	29
32	9.845919	9.852994	9.992925	10.007075	28
33	9.846047	9.852869	9.993178	10.006822	27
34	9.846175	9.852745	9.993430	10.006569	26
35	9.846304	9.852620	9.993683	10.006317	25
36	9.846432	9.852496	9.993936	10.006064	24
37	9.846560	9.852371	9.994189	10.005811	23
38	9.846688	9.852246	9.994441	10.005559	22
39	9.846816	9.852122	9.994694	10.005306	21
40	9.846944	9.851997	9.994947	10.005053	20
41	9.847071	9.851872	9.995199	10.004801	19
42	9.847199	9.851747	9.995452	10.004548	18
43	9.847327	9.851622	9.995701	10.004295	17
44	9.847454	9.851497	9.995957	10.004043	16
45	9.847582	9.851372	9.996210	10.003790	15
46	9.847709	9.851246	9.996463	10.003537	14
47	9.847836	9.851121	9.996715	10.003285	13
48	9.847964	9.850996	9.996968	10.003032	12
49	9.848091	9.850870	9.997220	10.002779	11
50	9.848218	9.850745	9.997473	10.002527	10
51	9.848345	9.850619	9.997726	10.002274	9
52	9.848472	9.850493	9.997979	10.002021	8
53	9.848599	9.850367	9.998231	10.001769	7
54	9.848726	9.850242	9.998484	10.001516	6
55	9.848852	9.850116	9.998737	10.001263	5
56	9.848979	9.849990	9.998989	10.001011	4
57	9.849106	9.849864	9.999242	10.001758	3
58	9.849232	9.849737	9.999495	10.000505	2
59	9.849359	9.849611	9.999747	10.000253	1
60	9.849485	9.849485	10.000000	10.000000	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 45.

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TABLE

OF

Logarithm Numbers,

From One to Ten thouſand:

Whereby the

LOGARITHM

OF ANY

NUMBER

Under four hundred thouſand may be readily diſcovered.

LONDON:

Printed by *M. Clark*, *Anno Dom.* MDCLXXXIV.

N	
1	0.
2	0.
3	0.
4	0.
5	0.
6	0.
7	0.
8	0.
9	0.
10	1.
11	1.
12	1.
13	1.
14	1.
15	1.
16	1.
17	1.
18	1.
19	1.
20	1.
21	1.
22	1.
23	1.
24	1.
25	1.
26	1.
27	1.
28	1.
29	1.
30	1.
31	1.
32	1.
33	1.

N	Log.	N	Log.	N	Log.
1	0.000000	34	1.531479	67	1.826075
2	0.301030	35	1.544068	68	1.832509
3	0.477121	36	1.556303	69	1.838849
4	0.602060	37	1.568202	70	1.845098
5	0.698970	38	1.579783	71	1.851258
6	0.778151	39	1.591064	72	1.857332
7	0.845098	40	1.602060	73	1.863323
8	0.903090	41	1.612784	74	1.869232
9	0.954242	42	1.623249	75	1.875061
10	1.000000	43	1.633468	76	1.880813
11	1.041393	44	1.643452	77	1.886491
12	1.079181	45	1.653212	78	1.892094
13	1.113943	46	1.662758	79	1.897627
14	1.146128	47	1.672098	80	1.903090
15	1.176091	48	1.681241	81	1.908485
16	1.204120	49	1.690196	82	1.913814
17	1.230449	50	1.698970	83	1.919078
18	1.255272	51	1.707570	84	1.924279
19	1.278753	52	1.716003	85	1.929419
20	1.301030	53	1.724276	86	1.934498
21	1.322219	54	1.732394	87	1.939519
22	1.342422	55	1.740362	88	1.944482
23	1.361728	56	1.748188	89	1.949390
24	1.380211	57	1.755875	90	1.954242
25	1.397940	58	1.763428	91	1.959041
26	1.414973	59	1.770852	92	1.963788
27	1.431364	60	1.778151	93	1.968483
28	1.447158	61	1.785330	94	1.973128
29	1.462398	62	1.792391	95	1.977723
30	1.477121	63	1.799340	96	1.982271
31	1.491361	64	1.806180	97	1.986772
32	1.505150	65	1.812913	98	1.991226
33	1.518514	66	1.819544	99	1.995635

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100	000000	000434	000868	001301	001734
101	004321	004751	005181	005609	006038
102	008600	009026	005451	009876	010299
103	012837	013259	013679	014100	014521
104	017033	017451	017898	018284	018700
105	021189	021603	022016	022428	022841
106	025306	025715	026125	026533	026942
107	029384	029789	030195	030599	031004
108	033424	033826	034227	034628	035029
109	037426	037825	038223	038620	039017
110	041393	041787	042182	042576	042969
111	045323	045714	046105	046495	046885
112	049218	049603	049993	050379	050766
113	053078	053463	053846	054229	054613
114	056905	057286	057666	058046	058426
115	060698	061075	061452	061829	062206
116	064458	064832	065206	065579	065953
117	068186	068557	068928	069298	069668
118	071882	072249	072617	072985	073352
119	075547	075912	076276	076640	077004
120	079181	079543	079904	080266	080626
121	082785	083144	083503	083861	084219
122	086359	086716	087071	087426	087781
123	089905	090258	090610	090963	091315
124	093422	093772	094122	094471	094820
125	096910	097257	097604	097951	098298
126	100371	100715	101059	101403	101747
127	103804	104146	104487	104828	105169
128	107209	107549	107888	108227	108565
129	110589	110926	111263	111599	111934

5	6	7	8	9	D
002166	002598	003029	003461	003891	432
006466	006894	007321	007748	008174	428
010724	011147	011570	011993	012415	424
014940	015359	015779	016197	016615	416
019116	019532	019947	020361	020775	416
023252	023664	024075	024486	024896	412
027349	027757	028164	028571	028978	408
031408	031812	032216	032619	033021	404
035429	035829	036229	036629	037028	400
039414	039811	040207	040602	040998	396
043362	043755	044148	044539	044932	393
047275	047664	048053	048442	048830	389
051153	051538	051924	052309	052694	386
054996	055378	055760	056142	056524	382
058805	059185	059563	059942	060320	379
062582	062958	063333	063709	064083	376
066326	066659	067071	067443	067815	372
070038	070407	070776	071145	071514	369
073718	074085	074451	074816	075182	366
077368	077731	078094	078457	078819	363
080987	081347	081707	082067	082426	360
084576	084934	085291	085647	086004	357
088136	088490	088845	089198	089552	355
091667	092018	092369	092721	093071	51
095169	095518	095866	096215	096562	349
098644	098989	099335	099681	100026	346
102091	102434	102777	103119	103462	343
105510	105851	106191	106531	106871	340
108903	109241	109579	109916	110253	338
112269	112605	112939	113275	113609	335

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130	113943	114277	114611	114944	115278
131	117271	117603	117934	118265	118595
132	120574	120903	121231	121559	121888
133	123852	124178	124504	124830	125156
134	127105	127429	127753	128076	128399
135	130334	130655	130977	131298	131619
136	133539	133858	134177	134496	134814
137	136721	137037	137354	137671	137987
138	139879	140194	140508	140822	141136
139	143015	143327	143639	143951	144263
140	146128	146438	146748	147058	147367
141	149219	149527	149835	150142	150449
142	152288	152594	152899	153205	153509
143	155336	155639	155943	156246	156549
144	158362	158664	158965	159266	159567
145	161368	161667	161967	162266	162564
146	164353	164650	164947	165244	165541
147	167317	167613	167908	168203	168497
148	170262	170555	170848	171141	171434
149	173186	173478	173769	174059	174351
150	176091	176381	176669	176959	177248
151	178977	179264	179552	179839	180126
152	181844	182129	182415	182699	182985
153	184691	184975	185259	185542	185825
154	187521	187803	188084	188316	188647
155	190332	190612	190892	191171	191451
156	193125	193403	193681	193959	194237
157	195899	196176	196453	196729	197005
158	198657	198932	199206	199481	199755
159	201397	201670	201943	202216	202488

5	6	7	8	9	D
115611	115943	116276	116608	116939	333
118926	119256	119586	119915	120245	330
122216	122544	122871	123198	123525	328
125481	125806	126131	126456	126781	325
128722	129045	129368	129689	130012	323
131939	132259	132579	132899	133219	321
135133	135451	135769	136086	136403	318
138303	138618	138934	139249	139564	315
141449	141763	142076	142389	142702	314
144574	144885	145196	145507	145818	311
147676	147985	148294	148603	148911	309
150756	151063	151369	151676	151982	307
153815	154119	154423	154728	155032	305
156852	157154	157457	157759	158061	303
159868	160168	160469	160769	161068	301
162863	163161	163459	163758	164055	299
165838	166134	166430	166726	167022	297
168792	169086	169380	169674	169968	295
171726	172019	172311	172603	172895	293
174641	174932	175222	175512	175802	291
177536	177825	178113	178401	178689	289
180413	180699	180986	181272	181558	287
183269	183555	183839	184123	184407	285
186108	186391	186674	186956	187239	283
188928	189209	189490	139771	190051	281
191730	192009	192289	192567	192846	279
194514	194792	195069	195346	195623	278
197281	197556	197832	198107	198382	276
200029	200303	200577	200850	201124	274
202761	203033	203303	203577	203848	272

The Table of Logarithms.

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160	104119	204391	204663	204934	205204
161	206826	207096	207365	207364	207904
162	209515	209783	210051	210319	210586
163	212187	212454	212720	212986	213252
164	214844	215109	215373	215638	215902
165	217484	217747	218010	218273	218536
166	220108	220369	220631	220892	221153
167	222716	222676	223236	223496	223755
168	225309	225568	225827	226084	226342
169	227887	228142	228400	228657	228913
170	230449	230704	230959	231215	231469
171	232996	233250	233504	23375	234011
172	235528	235781	236033	236285	236537
173	238046	238297	238548	238799	239049
174	240549	240799	241048	241297	241546
175	243038	243286	243534	243782	244029
176	245513	245759	246006	246252	246499
177	247973	248219	248464	248709	248954
178	250420	250664	250908	251151	251395
179	252853	253096	253334	253580	253822
180	255273	255514	255755	255996	256237
181	257679	257918	258158	258398	258637
182	260071	260309	260548	260787	261025
183	262451	262688	262925	263162	263399
184	264818	265054	265289	265525	265761
185	267172	267406	267641	267875	268109
186	269513	269746	269979	270213	270446
187	271842	272074	272306	272538	272769
188	274158	274389	274619	274850	275081
189	276462	276692	196921	277151	277379

The Table of Logarithms.

5	6	7	8	9	D
205[illegible]75	205746	206016	206286	206556	271
208173	208441	208710	208978	209247	269
210853	211121	211388	211654	211921	267
213518	213783	214049	214314	214579	266
216166	216429	216694	216957	217221	264
218798	219060	219323	219585	219846	262
221414	221675	221936	222196	222456	261
224015	224274	224533	224791	225051	259
226599	226858	227115	221372	227629	258
229169	229426	229682	229938	230193	256
231724	231979	232234	232488	232742	254
234264	234517	234770	235023	235276	253
236789	237041	237292	237544	237795	252
239299	239549	239799	240049	240299	250
241795	242044	242293	242541	242789	249
244277	244525	244772	245019	245266	248
246745	246991	247237	247482	247728	246
245198	249443	249687	249932	250176	245
251638	251881	252125	252368	252610	243
254064	254306	254548	254789	255031	242
256477	256718	256958	257198	257438	241
258877	259116	250355	259594	259833	239
261263	261501	261739	261976	262214	238
263636	263873	264109	264346	264582	237
265996	266232	266467	266702	266937	235
268344	268578	268812	269046	269279	234
270679	270912	271144	271377	271609	233
273001	273233	273464	273696	273927	232
275311	275542	275772	276002	276232	230
277609	277838	278067	278296	278525	229

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190	278754	278982	279211	279439	276667
191	281033	281261	281488	281714	281942
192	283301	283527	283753	283979	284205
193	285557	285782	286007	286232	286456
194	287802	288026	288249	288473	288696
195	290035	290257	290479	290702	290925
196	292256	292478	292699	292920	293141
197	294466	294687	294907	295127	295347
198	296665	296884	297104	297323	297542
199	298853	299071	199289	299507	299725
200	301030	301247	301464	301681	301898
201	303196	303412	303628	303844	304059
202	305351	305566	305781	305996	306211
203	307496	307709	307924	308137	308351
204	309630	309843	310056	310268	310481
205	311754	311966	312177	312389	312600
206	313867	314078	314289	314499	314709
207	315970	316180	316389	316599	316809
208	318063	318272	318481	318689	318898
209	320146	320354	320562	320769	320977
210	322219	322426	322633	322839	323046
211	324282	324488	324694	324899	325105
212	326336	326541	326745	326949	327155
213	328379	328583	328787	328991	329194
214	330414	330617	330819	331022	331225
215	332438	332640	332842	333044	333246
216	334454	334655	334856	335057	335257
217	336459	336659	336859	337059	337259
218	338456	338656	338856	339054	339253
219	340444	340642	340841	341039	341237

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279895	280123	280351	280578	280806	228
282169	282396	282622	282849	283075	227
284431	284656	284882	285107	285332	226
286681	286905	287129	287354	287578	225
288919	289143	289366	289589	289812	223
291147	291369	291591	291813	292034	222
293362	293584	293804	294025	294246	221
295567	295787	296007	296226	296446	220
297761	297979	298198	298416	298635	219
299943	200161	300378	200595	300813	218
302114	302331	302547	302764	302979	217
304275	304491	304706	304921	305136	216
306425	306639	306854	307068	307282	215
308564	308778	308991	309204	309417	213
310693	310906	311118	311329	311542	212
312812	313023	313234	313445	313656	211
314920	315130	315340	315551	315760	210
317018	317227	317436	317646	317854	209
319106	319314	319522	319730	319938	208
321184	321391	321598	321805	322012	207
323252	323458	323665	323871	324077	206
325310	325516	325721	325926	326131	205
327359	327563	327767	327972	328176	204
329398	329601	329805	330008	330211	203
331427	331629	331832	332034	332236	202
333447	333649	333859	334051	334253	202
335458	335658	335859	336059	336259	201
337459	337659	337859	338058	338257	200
339453	339650	339849	340047	340246	199
3 1435	341632	341830	342028	342225	198

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220	342227	342620	342817	343014	343212
221	344392	344589	344785	344981	345178
222	346353	346549	346744	346939	347135
223	348305	348499	348694	348889	349083
224	350248	350442	350636	350829	351023
225	352183	352375	352568	352761	352954
226	354108	354301	354493	354685	354876
227	356026	356217	356408	356599	356790
228	357935	358125	358316	358506	358696
229	359835	360025	360215	360404	360593
230	361728	361917	362105	362294	362482
231	363612	363799	363988	364176	364363
232	365488	365675	365862	366049	366236
233	367356	367542	367729	367915	368101
234	369216	369401	369587	369772	369958
235	371068	371253	371437	371622	371806
236	372912	373096	373279	373464	373647
237	374748	374932	375115	375298	375481
238	376577	376159	376942	377124	377306
239	378398	378579	378761	378943	379124
240	380211	380392	380573	380754	380934
241	382017	382197	382377	382557	382737
242	383815	383995	384174	384353	384533
243	385606	385785	385964	386142	386321
244	387389	387568	387746	387923	388101
245	389166	389343	389520	389698	389875
246	390935	391112	391288	391464	391641
247	392697	392873	393048	393224	393399
248	394452	394627	394802	394977	395152
249	396199	396374	396548	396722	396896

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343409	343606	343802	343999	344196	197
345373	345569	345766	345962	346157	196
347330	347525	347720	347915	348110	195
349278	349472	349659	349860	350054	194
351216	351409	351603	351796	351989	193
353147	353339	353532	353724	353916	193
355068	355239	355452	355643	355834	192
356981	357172	357363	357554	357744	191
358886	359076	359266	359456	359646	190
360783	360972	361161	361350	361539	189
362671	362859	363048	363236	363424	188
364551	364739	364926	365113	365301	188
366423	366609	366796	366983	367169	187
368287	368473	368659	368345	369030	186
370143	370328	370513	370698	370882	185
371991	372175	372359	372544	372728	184
373831	374015	374198	374382	374565	184
375664	375846	376029	376212	376394	183
377488	377670	377852	378034	378216	182
379306	379487	379668	379849	380030	181
381115	381296	381476	381656	381837	181
382917	383097	383277	383456	383636	180
384712	384891	385069	385249	385428	179
389499	386677	386856	387034	387212	173
388279	388456	388634	388811	388989	178
390051	390228	390405	390582	390759	177
391817	391993	392169	392345	392521	176
393575	393751	393926	394101	394277	176
395326	395501	395676	395850	396025	175
397071	397245	397419	397592	397766	174

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252	401401	401573	401745	401917	402089
253	403121	403292	403464	403635	403807
254	404834	405005	405176	405346	405517
255	406540	406710	406881	407051	407221
256	408239	408409	408579	408749	408918
257	409933	410102	410271	410439	410609
258	411619	411788	411956	412124	412293
259	413299	413467	413635	413803	413969
260	414973	415140	415307	415474	415641
261	416641	416807	416973	417139	417306
262	418301	418467	418633	418798	418964
263	419956	420131	420289	420451	420616
264	421604	421768	421933	422097	422261
265	423246	423409	423574	423737	423901
266	424882	425045	425208	425371	425534
267	426511	426674	426836	426999	427161
268	428135	428297	428459	428621	428783
269	429752	429914	430075	430236	430398
270	431369	431525	431685	431846	432007
271	432969	433129	433289	433449	433609
272	434569	434729	434888	435048	435207
273	436163	436322	436481	436639	436799
274	437751	437909	438067	438226	438384
275	439333	439491	439648	439806	439964
276	440909	441066	441224	441381	441538
277	442479	442637	442793	442949	443106
278	444045	444201	444357	444513	444669
279	445604	445759	445915	446071	446226

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398808	398981	399154	399328	399501	173
400538	400711	400883	401056	401228	173
402261	402433	402605	402777	402949	172
403978	404149	404320	404492	404663	171
405688	405858	406029	406199	406369	171
407391	407561	407731	407901	408070	170
409087	409257	409426	409595	409764	169
410777	410946	411114	411283	411451	169
412461	412629	412796	412964	413132	168
414137	413405	414472	414639	414806	167
415808	415974	416141	416308	416474	167
417472	417638	417804	417969	418135	166
419129	419295	419460	419625	419791	165
420781	420945	421110	421275	421439	165
422426	422589	422754	422918	423082	164
424065	424228	424392	424555	424718	164
425697	425860	426023	426186	426349	163
427324	427486	427648	427811	427973	162
428944	429106	429268	429429	429591	162
430559	430719	430881	431042	431203	161
432167	432328	432488	432649	432809	161
433769	433929	434089	434249	434409	160
435366	435526	435685	435844	436004	159
436957	437116	437275	437433	437592	159
438542	438701	438859	439175	439165	158
440122	440279	440437	440594	440752	158
441695	441852	442009	442166	442323	157
443263	443419	443576	443732	443889	157
444825	44498	445137	445293	445449	156
446382	446537	446692	446848	447003	155

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281	448706	448861	449015	449169	449324
282	452049	450403	450557	450711	450865
283	451786	451939	452093	452247	452399
284	453318	453471	453624	453777	453929
285	454845	454997	455149	455302	455454
286	456366	456518	456669	456821	456973
287	457889	458033	458 84	458336	458487
288	459392	459543	459694	459845	459995
289	460898	461048	461198	461348	461499
290	462398	462548	462647	462847	462997
291	463893	464042	464191	464340	464489
292	465383	465532	465680	465829	465977
293	466868	467016	467164	467312	467460
294	468347	468495	468643	468790	468938
295	469822	469969	470116	470263	470410
296	471292	471438	471585	471732	471878
297	472756	472903	473049	473195	473341
298	474216	474362	474508	474653	474799
299	475671	475816	475962	476107	476252
300	477121	477266	477411	477555	477699
301	478566	478711	478855	478999	479143
302	480007	480151	480294	480438	480582
303	481443	481586	481729	481872	482016
304	482874	483016	483159	483302	483 45
305	484299	484442	484585	484727	484869
306	485721	485863	486005	486147	486289
307	487138	87279	487421	487563	487704
308	488551	488692	488333	488974	489114
309	489958	490099	490239	490379	490520

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449478	449633	449787	459941	450095	154
451018	451172	451326	451479	451633	154
452553	452706	452859	453012	453165	153
454082	454235	454387	454539	454692	153
455606	455758	455910	456062	456214	152
457125	457276	457428	457579	457731	152
458638	458789	458939	459091	459242	151
460146	460296	460447	460597	460748	151
461649	461799	461948	462098	462248	150
463146	463296	463445	463594	463744	150
464639	464788	464936	465085	465234	149
466126	466274	466423	466571	466719	149
467608	467756	467904	468052	468199	148
969085	469233	469380	469527	469675	147
470557	470704	470851	470998	471145	147
472025	472171	472318	472464	472610	145
473487	473633	473779	473925	474071	146
474944	475089	475235	475381	475526	141
476397	476542	476687	476832	476976	145
477844	477989	478133	478278	478422	145
479287	479431	479575	479719	479863	144
480725	480869	481012	481156	431299	144
482159	482302	482445	482588	482731	143
483587	483729	483872	484015	484157	143
485011	485153	485295	485437	485579	142
486430	486572	486714	486855	486997	142
487845	487986	488127	488269	438409	141
489255	489396	489537	489677	4[illegible]9818	141
490661	490801	490941	491[illegible]81	491222	140

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311	492760	492900	493039	493179	493319
312	494155	494294	494433	494572	494711
313	495544	495683	495822	495960	496099
314	496929	497068	497206	497344	497483
315	498311	498448	498586	498724	498862
316	499687	499824	499962	500099	500236
317	501059	501196	501333	501470	501607
318	502427	502564	502700	502837	502973
319	503791	503927	504063	504199	504335
320	505149	505286	505421	505557	505193
321	506505	506640	506776	506911	507046
322	507856	507991	508126	508260	508395
323	509203	509337	509471	509606	509740
324	510545	510679	510813	510947	511081
325	511883	512017	512151	512284	512418
326	513218	513351	513485	513617	513750
327	514548	514681	514813	514946	515079
328	515874	516006	516139	516271	516403
329	517196	517328	517459	517592	517724
330	518514	518646	518777	518909	519040
331	519828	519959	520090	520221	520353
332	521138	521269	521399	521530	521661
333	522454	522575	522705	522835	522966
334	523746	523876	524006	524136	524266
335	520545	525174	525304	525434	525563
336	526339	526469	526598	526727	526856
337	527629	527759	527888	528016	528145
338	528916	529045	529174	529302	529430
339	530199	530328	530456	530584	530712

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493458	493597	493737	493876	494015	139
494850	494989	495128	495267	495406	139
496238	496376	496515	496653	496791	139
497921	497759	497897	498035	498173	138
498999	495137	499275	499412	499549	138
500374	500510	500648	500785	500922	137
501744	501880	502017	502154	502291	137
503109	503246	503382	503518	593655	136
504471	504607	504743	504878	505014	136
505828	505964	506099	506234	506369	136
507181	507316	507451	507586	507721	135
508529	508664	508799	508934	509068	135
509894	510009	510143	510277	510411	134
511215	511349	511482	511616	511749	134
512551	512684	512818	512951	513084	133
513883	514016	514149	514282	514415	133
515211	515344	515476	515609	515741	133
516535	516668	516796	516932	517064	132
517855	517987	518119	518251	518382	132
519171	519303	519434	519566	519697	131
520484	520615	520745	520876	521007	131
521792	521922	522053	522183	522314	131
523096	523226	523356	523486	523616	130
524396	524526	524656	524785	524915	130
525693	525822	525951	526081	526210	129
526985	527114	527243	527372	527501	129
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533	726727	726809	726890	726972	727053
534	727541	727623	727704	727785	727866
535	728354	728435	728516	728597	728678
536	729165	729246	729327	729408	729489
537	729974	730055	730136	730217	730298
538	730782	730863	730944	731024	731105
539	731589	731669	731749	731830	731911
540	732394	732474	732555	732635	732715
541	733197	733278	733358	733438	733518
542	733999	734079	734159	734239	734319
543	734799	734879	734959	735039	735119
544	735599	735679	735759	735838	735918
545	736397	736476	736556	736635	736715
546	737193	737272	737352	737431	737511
547	737987	738067	738146	738225	738305
548	738781	738859	738939	739013	739097
549	739572	739651	739731	739809	739889

5	6	7	8	9	D
716421	716504	716588	716671	716754	83
717254	717338	717421	717509	717587	83
718086	718169	718253	718336	718419	83
718917	718999	719083	719165	719248	83
719745	719828	719911	719994	720077	83
720573	720655	720738	720821	720903	83
721398	721481	721563	721646	721728	82
722222	722305	722387	722469	722552	82
723045	723127	723209	723291	723374	82
723866	723948	724029	724112	724194	82
724685	724767	724849	724931	725013	82
725503	725585	725667	725748	725829	82
726319	726401	726483	726564	726646	82
727134	727216	727297	727379	727459	81
727948	728029	728110	728191	728273	81
728759	728841	728922	729003	729084	81
729569	729651	729732	729813	729893	81
730378	730459	730540	730621	730702	81
731186	731266	731347	731423	731508	81
731991	732072	732152	732233	732313	81
732796	732876	732956	733037	733117	80
733598	733679	733759	733839	733919	80
734399	734479	734559	734639	734719	80
735199	735279	735359	735439	735519	80
735998	736078	736157	736237	736317	80
736795	736874	736954	737034	737113	80
737590	737669	737749	737829	737908	79
738384	738463	738543	738622	738701	79
739177	739259	739335	739414	739493	79
739968	740047	740126	740205	740284	79

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550	740363	740442	740521	740599	740678
551	741152	741230	741309	741388	741467
552	741939	742018	742096	742175	742254
553	742725	742802	742882	742961	743039
554	743509	743588	743667	743745	743823
555	744293	744371	744449	744528	744606
556	745075	745153	745231	745309	745387
557	745855	745933	746011	746089	746167
558	746634	746712	746789	746868	746945
559	747412	747489	747567	747645	747722
560	748188	748266	748343	748421	748498
561	748963	749041	749118	749195	749272
562	749736	749814	749891	749968	750045
563	750508	750586	750663	750739	750817
564	751279	751356	751433	751510	751587
565	752048	752125	752202	752279	752356
566	752816	752893	752969	753047	753123
567	753583	753659	753736	753813	753889
568	754348	754425	754501	754578	754654
569	755112	755189	755265	755341	755417
570	755875	755951	756027	756103	756179
571	756636	756712	756788	756864	756940
572	757396	757472	757548	757627	757699
573	758155	758230	758306	758382	758458
574	758912	758988	759063	759139	759214
575	759668	759743	759819	759894	759969
576	760422	760498	760573	760649	760723
577	761176	761251	761326	761401	761477
578	761928	762003	762078	762153	762228
579	762679	762754	762829	762904	762978

The Table of Logarithms.

5	6	7	8	9	D
740757	740836	740915	740994	741073	79
741546	741624	741703	741782	741860	79
742332	742411	742489	742568	742647	79
743118	743196	743275	743353	743431	78
743902	743979	744058	744136	744215	78
744684	744764	744840	744919	744997	78
745465	745543	745621	745699	745777	78
746245	746323	746401	746479	746556	78
747023	747101	747179	747256	747334	78
747800	747878	747955	748033	748110	78
74857[illegible]	748653	748731	748808	748885	77
749349	749427	749504	749582	749659	77
750123	750199	750277	750354	750431	77
750894	750971	751048	751125	751202	77
751664	751741	751818	751895	751972	77
752433	752509	752586	752663	752739	77
753199	753277	753353	753429	753506	77
753966	754042	754119	754195	754272	77
754730	75480	754883	754959	755036	76
755494	755565	755645	755722	755799	76
756256	756332	756408	756484	756560	75
757016	757092	757167	757244	757320	75
757775	757851	757927	758003	758079	76
758533	758609	758685	758761	758836	76
759290	759366	759411	759517	759592	76
60045	760121	760196	76027[illegible]	760347	75
760799	760875	760949	761025	761101	75
761552	761627	761702	761778	761853	75
762303	762378	762453	762529	762604	75
763053	763128	763203	763279	763353	75

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580	763428	763503	763578	763653	763727
581	764176	764251	764326	764400	764475
582	764923	764998	765072	765147	765221
583	765669	765743	765818	765892	765966
584	766413	766487	766562	766636	766710
585	767156	767230	767304	767379	767453
586	767898	767972	768046	768119	768194
587	768638	768712	768786	768860	768934
588	769377	769451	769525	769599	769673
589	770115	770189	770263	770336	770410
590	770852	770926	770999	771073	771146
591	771587	771661	771734	771808	771881
592	772322	772395	772468	772542	772615
593	773055	773128	773201	773274	773348
594	773786	773859	773933	774006	774079
595	774517	774589	774663	774736	774809
596	775246	775319	775392	775465	775538
597	775974	776047	776119	776193	776265
598	776701	776774	776846	776919	776992
599	777427	777499	777572	777644	777717
600	778151	778224	778296	778368	778441
601	778874	778947	779019	779091	779163
602	779596	779669	779741	779813	779884
603	780317	780389	780461	780533	780605
604	781037	781109	781181	781253	781324
605	781755	781827	781899	781971	782042
606	782473	782544	782616	782688	782759
607	783189	783260	783332	783403	783475
608	783904	783975	784046	784118	784189
609	784617	784689	784759	784831	784902

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5	6	7	8	9	D
763802	763877	763952	764027	764101	75
764549	764624	764699	764774	764848	75
765296	765370	765445	765519	765594	75
766041	766115	766189	766264	766338	74
766785	766859	766933	767007	767082	74
767527	767601	767675	767749	767823	74
768268	768342	768416	768490	768564	74
769008	769082	769156	769229	769303	74
769746	799820	769894	769968	770042	74
770484	770557	770631	770705	770778	74
771219	771293	771367	771440	771514	74
771955	772028	772102	772175	772248	73
772688	772762	772835	772908	772981	73
773421	773494	773567	773640	773713	73
774152	774225	774298	774371	774444	73
774882	774955	775028	775100	775173	73
775610	775683	775756	775829	775902	73
776338	776411	776483	776556	776629	73
777064	777137	777209	777282	777354	73
777789	777862	777934	778006	778079	72
778513	778585	778658	778729	778802	72
779236	779308	779380	779452	779524	72
779957	780029	780101	780173	780245	72
780677	780749	780821	780893	780965	72
781396	781468	781539	781612	781684	72
782114	782186	782258	782329	782401	72
782831	782902	782974	783046	783117	72
783546	783618	783689	783761	783832	71
784261	784332	784403	784475	784546	71
784974	785045	785116	785187	785259	71

N	0	1	2	3	4
610	785329	785401	785472	785543	785615
611	786041	786112	786183	786254	786325
612	786751	786822	786893	786964	787035
613	787460	787531	787602	787673	787744
614	788164	788239	788309	788381	788451
615	788875	788946	789016	789087	789157
616	789581	789651	789722	789792	789863
617	790285	790356	790426	790496	790567
618	790988	791059	791129	791199	791269
619	791691	791761	791831	791901	791971
620	792392	792462	792532	792602	792672
621	793092	793162	793231	793301	793371
622	793791	793860	793930	793999	794069
623	794488	794558	794627	794697	794767
624	795185	795254	795324	795393	795463
625	795880	795949	796019	796088	796158
626	796574	796644	796713	796782	796852
627	797268	797337	797406	797475	797545
628	797959	798029	798098	798167	798236
629	798651	798719	798789	798858	798927
630	799341	799409	799478	799547	799616
631	800029	800098	800167	800236	800305
632	800717	800786	800854	800923	800992
633	801404	801472	801541	801609	801678
634	802089	802158	802226	802295	802363
635	802774	802842	802910	802979	803047
636	803457	803525	803594	803662	803730
637	804139	804208	804276	804344	804412
638	804821	804889	804957	805025	805093
639	805501	805569	805637	805705	805773

5	6	7	8	9	D
785686	785757	785828	785899	785970	71
786396	786467	786538	786609	786680	71
787106	787177	787248	787319	787389	71
787815	787885	787956	788027	788098	71
788522	788593	788663	788734	788804	71
789228	789299	789369	789439	789510	71
789933	790004	790074	790144	790215	70
790637	790707	790778	790848	790918	70
791339	791409	791480	791550	791620	70
792041	792111	792181	792252	792322	70
792742	792812	792882	792952	793022	70
793441	793511	793581	793651	793721	70
794139	794209	794279	794349	794418	70
794836	794906	794976	795045	795115	70
795532	795602	795672	795741	795810	70
796227	796297	796366	796436	796505	69
796921	796990	797059	797129	797198	69
797614	797683	797752	797821	797890	69
798305	798374	798443	798513	798582	69
798996	799065	799134	799203	799272	69
799685	799754	799823	799892	799961	69
800373	800442	800511	800579	800648	69
801061	801129	801198	801266	801335	69
801747	801815	801884	801952	802021	69
802432	802500	802568	802637	802705	69
803116	803184	803252	803321	803389	68
803798	803867	803935	804003	804071	68
804480	804548	804616	804685	804753	68
805161	805229	805297	805365	805433	68
805841	805909	805976	806044	806112	68

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640	806179	806248	806316	806384	806451
641	806858	806926	806994	807061	807129
642	807535	807603	807670	807738	807806
643	808211	808279	808346	808414	808481
644	808886	808953	809021	809088	809156
645	809559	809627	809694	809762	809829
646	810233	810299	810367	810434	810501
647	810904	810971	811039	811106	811173
648	811575	811642	811709	811776	811843
649	812245	812312	812379	812445	812512
650	812913	812980	813047	813114	813181
651	813581	813648	813714	813781	813848
652	814248	814314	814381	814447	814514
653	814913	814979	815046	815113	815129
654	815578	815644	815711	815777	815843
655	816241	816308	816374	816440	816506
656	816904	816910	817036	817102	817169
657	817565	817631	817698	817764	817829
658	818226	818292	818358	818424	818489
659	818885	818951	819017	819083	819149
660	819543	819609	819676	819741	819807
661	820201	820267	820333	820399	820464
662	820858	820924	820989	821055	821120
663	821514	821509	821645	821709	821775
664	822168	822233	822299	822364	822429
665	822 22	822887	822952	823018	823083
666	823474	823539	823605	823669	823735
667	824126	824191	824256	824321	824386
668	824776	824841	824906	824971	825036
669	825426	825491	825556	825021	825686

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5	6	7	8	9	D
806519	806587	806655	806723	806790	68
807197	807264	807332	807399	807467	68
807873	807941	808008	808076	808143	68
808549	808616	808684	808751	808818	67
809223	809290	809358	809425	809492	67
809866	809964	810031	810098	810165	67
810569	810636	810703	810770	810837	67
811239	811307	811374	811441	811508	67
811909	811977	812044	812111	812178	67
812579	812646	812713	812779	812847	67
813247	813314	813381	813448	813514	67
813914	813981	814048	814114	814181	67
814581	814647	814714	814780	814847	67
815246	815312	815378	815445	815511	66
815909	815976	816042	816109	816175	66
816573	816639	816705	816771	816838	66
817235	817301	817367	817433	817499	66
817896	817962	818028	818094	818159	66
818556	818622	818688	818754	818819	66
819215	819281	819346	819412	819478	66
819873	819939	820004	820070	820136	66
820529	820595	820661	820727	820792	66
821186	821251	821317	821382	821448	66
821841	821906	821972	822037	822103	65
822495	822560	822626	822691	822756	65
823148	823213	823279	823344	823409	65
823800	823865	823930	823996	824061	65
824451	824516	824581	824646	824711	65
825101	825166	825231	825296	825361	65
825751	825815	825880	825945	826009	65

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670	826075	826139	826204	826269	826334
671	826723	826787	826852	826917	826981
672	827369	827434	827499	827563	827628
673	828015	828079	828144	828209	828273
674	828659	828724	828789	828853	828918
675	829304	829368	829432	829497	829561
676	829947	830011	830075	830139	830204
677	830589	830653	830717	830781	830845
678	831229	831294	831358	831422	831486
679	831869	831934	831998	832062	832126
680	832509	832573	832637	832700	832764
681	833147	833211	833275	833338	833402
682	833784	833848	833912	833975	834039
683	834421	834484	834548	834611	834675
684	835056	835119	835183	835247	835310
685	835691	835754	835817	835881	835944
686	836324	836387	836451	836514	836577
687	836957	837019	837083	837146	837209
688	837588	837652	837715	837777	837841
689	838219	838282	838345	838408	838471
690	838849	838912	838975	839038	839101
691	839478	839541	839604	839667	839729
692	840106	840169	840232	840394	840357
693	840733	840796	840859	840921	840984
694	841359	841423	841485	841547	841609
695	841985	842047	842109	842172	842235
696	842609	842672	842734	842796	842859
697	843233	843295	843357	843419	843482
698	843855	843918	843979	844042	844104
699	844477	844539	844601	844664	844726

5	6	7	8	9	D
826399	826464	826528	826593	826658	65
827046	827111	827175	827239	827 05	65
827692	827757	827822	827886	827951	65
828338	828402	828467	828531	828595	64
828982	829046	829111	829175	829239	64
829625	829689	829754	829818	829882	64
830268	830332	830396	830460	830525	64
830909	830973	831037	831102	831166	64
831549	831614	831678	831742	831806	64
833189	832253	832317	832381	832445	64
832828	832892	832956	833019	833083	64
833466	833529	833593	833657	833721	64
834103	834166	834229	834294	834357	64
834739	834802	834866	834929	834993	64
835373	835437	835500	835564	835627	63
836007	836071	836134	836197	836261	63
836641	836704	836767	836830	836894	63
837273	837339	837399	837462	837525	63
837904	837967	838030	838093	838156	63
838534	838597	838660	83872	838786	63
839164	839227	839289	839352	839415	63
839792	839855	839918	839981	840043	63
840419	840482	840545	840608	840671	63
841049	841109	841172	841234	841297	63
841672	841735	84 797	841859	841922	63
842297	842359	842432	842484	842547	62
842921	842983	843046	843108	843170	62
843544	843606	843669	843731	843293	62
844166	844229	844291	844353	844415	62
844788	844849	844912	844974	845036	62

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700	845098	845160	845222	845284	845346
701	845718	845779	845842	845904	845666
702	846337	846399	846461	846523	846585
703	846955	847017	847079	847141	847202
704	847573	847634	847696	847758	847819
705	848189	848251	848312	848374	848435
706	848805	848866	848928	848989	849051
707	849419	849481	849542	849604	849665
708	850033	850095	850156	850217	850279
709	850646	850707	850769	850829	850891
710	851258	851319	851381	851442	851503
711	851869	851931	851992	851053	852114
712	852479	852541	852602	852663	852724
713	853089	853150	853211	853272	853339
714	853693	853759	853819	853881	853941
715	854306	854367	854428	854488	854549
716	853913	854974	855034	855095	855156
717	855519	855579	855640	855701	855761
718	856124	856185	856245	856306	856366
719	856729	856789	856849	856910	856970
720	857332	857393	857453	857513	857574
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902	955207	955255	955303	955351	955399
903	955688	955736	955784	955832	955880
904	956168	956216	956265	956313	956361
905	956649	956697	956745	956793	956840
906	957128	957176	957224	955272	957319
907	957607	957655	957703	957751	957799
908	958086	958134	958181	958229	958277
909	958564	958612	958659	958707	958755

5	6	7	8	9	D
944729	944779	944828	944877	944927	49
945222	945272	945321	945370	945419	49
945715	945764	945813	945862	945912	49
9 6207	946256	946305	946354	946403	49
946698	946747	946796	946845	946894	49
947189	947238	947287	947336	947385	49
947679	947728	947777	947826	947875	49
948168	948217	948266	948315	948364	49
948657	948706	948755	948804	948853	49
949146	949195	949244	949292	949341	49
949633	949683	949731	949780	949829	49
950121	950170	950219	950267	950316	49
950608	950657	950706	950754	950803	49
951095	951143	951192	951240	951289	49
951580	951629	951677	951729	951775	49
952066	952114	952163	95221	952259	49
952550	952 99	952647	952696	952744	48
953034	953083	953131	953179	953228	48
953518	95 566	953615	953663	953711	48
954001	954049	954099	954146	954194	48
954484	954532	954580	954628	954677	48
954966	955014	955062	955110	955158	48
955447	955495	955543	955592	955639	48
955928	955976	956024	956075	956120	48
956409	956457	956505	955533	956601	48
956888	956936	956984	957032	957080	48
957368	957416	957464	957512	957559	48
957847	957894	957942	957900	958038	48
958325	958373	958421	958468	958516	48
958803	958850	958898	958946	958994	48

N	0	1	2	3	4
910	959041	959089	959137	959185	959231
911	959518	959566	959614	959661	959709
912	959995	960042	960090	960138	960185
913	960471	960518	960566	960613	960661
914	960946	960994	961041	961089	961136
915	961421	961469	961516	961563	961611
916	961895	961943	961990	962038	962085
917	962369	962417	962464	962511	962559
918	962842	962886	962937	962985	963032
919	963315	963363	963410	963457	963504
920	963788	963835	963882	963929	963977
921	964259	964307	964354	964401	964448
922	964731	964778	964825	964872	964919
923	965202	965249	965296	965343	965389
924	965672	965719	965766	965813	965859
925	966142	966189	966239	966283	966329
926	966611	966658	966705	966752	966799
927	967079	967127	967173	967220	967267
928	967548	967595	967642	967688	967735
929	968016	968062	968109	968156	968202
930	968483	968529	968576	968623	968669
931	968949	968996	969043	969089	969136
932	969416	969463	969509	969556	969602
933	969882	969928	969975	970021	970068
934	970347	970393	970439	970486	970533
935	970812	970858	970904	970951	970997
936	971286	971322	971369	971415	971461
937	971739	971786	971832	971879	971925
938	972203	972249	972295	972342	972388
939	972666	972712	972758	972804	972851

5	6	7	8	9	D
959279	959328	959375	959423	959471	48
959757	959804	959852	959899	959947	48
960233	960280	960328	960376	960423	48
960709	960756	960804	960851	960899	48
961184	961231	961279	961326	961374	47
961658	961706	961753	961801	961848	47
962132	962179	962227	962275	962322	47
962606	962653	962701	969748	962795	47
963079	963126	963174	963221	963258	47
963552	963599	963646	963693	96374	47
964024	964071	964118	964165	964212	47
964495	964542	964589	964637	954684	47
964966	965013	965061	965108	965155	47
965437	965484	955531	965578	965624	47
965905	965954	966001	966048	966095	47
966376	966423	966470	966517	966564	47
966845	966892	966939	966986	967033	47
967314	967361	967408	967454	967501	47
967782	967829	967875	967922	967969	47
968249	968296	968343	968389	968436	47
963716	968763	968809	968856	968902	47
969183	9692 9	969276	969323	969369	47
969649	9696[illegible]5	969741	969789	969835	47
970114	970161	970207	970254	970300	47
970579	97[illegible]6[illegible]6	980672	970719	970765	46
9710[illegible]4	971090	971137	971183	971229	46
971508	971554	971601	971647	971693	45
971971	972018	972064	972110	972157	46
972434	972481	972527	972573	972619	46
972897	972943	972989	973035	97308[illegible]	46

N	0	1	2	3	4
940	973128	973174	973220	973266	973313
941	973589	973636	973682	973728	973774
942	974050	974097	974143	974189	974235
943	974512	974558	974604	974649	974695
944	974972	975018	975064	97510[illegible]	975156
945	975432	975478	975524	975569	975616
946	975891	975937	975983	976029	976075
947	976349	976396	97644[illegible]	976488	976533
948	976808	976854	9768[illegible]9	976946	976992
949	977266	977312	9773[illegible]	977403	977449
950	977724	977769	9778[illegible]5	977861	977906
951	978181	978226	978272	978317	978363
952	978637	978683	9787[illegible]	978774	978819
953	979093	979138	97918[illegible]	979229	979275
954	979548	979594	979639	979685	979730
955	980003	980049	980094	980139	980185
956	980458	980503	980549	980594	980639
957	980912	980957	981003	981048	981093
958	981366	981411	981456	981501	981547
959	981819	981864	981909	981954	981999
960	982271	982316	982362	982407	982452
961	98[illegible]	982769	982814	982859	982904
962	983[illegible]75	983220	983265	983310	983356
963	983626	983671	983716	983762	983807
964	984077	984122	984167	98421[illegible]	984257
965	984527	98457[illegible]	984617	984662	984707
966	984977	985022	985067	985112	985157
967	9[illegible]5426	985471	985516	985561	85606
968	985875	985920	8596[illegible]	986009	986055
969	9[illegible]6324	9863[illegible]	8641	986459	986504

5	6	7	8	9	D
973359	973405	973451	973497	973543	46
973820	973866	973913	973959	974005	46
974281	974327	974374	974419	974466	46
974742	974788	974834	974819	974926	46
975202	975248	975294	975339	975386	46
975662	975707	975753	975799	975845	46
976121	976167	976212	976258	976304	46
976579	976625	976671	976717	976763	46
977037	977083	977129	977175	977220	46
977495	977541	977586	977632	977678	46
977952	977998	978042	978089	978135	46
978409	978454	978500	978546	978591	46
978865	978911	978956	979002	979047	46
979321	979366	979412	979457	979503	46
979776	979821	979867	979912	979958	46
980231	980276	980322	980367	980412	45
980685	980730	980776	980821	980867	45
981139	981184	981229	981275	981320	45
981592	981637	981683	981728	981773	45
982045	982090	982135	982181	982226	45
982497	982543	982588	982633	982678	45
982949	982994	983039	983085	983129	45
983401	983446	983490	983536	983581	45
983852	983897	983942	983987	984032	45
984302	984347	984392	984437	984482	45
984752	984797	984842	984887	984932	45
985202	985247	985292	985337	985382	45
985651	985696	985741	985786	985830	45
986099	986144	986189	986234	986279	45
986548	986592	986637	986682	986727	45

N	0	1	2	3	4
970	986772	986817	986861	986906	986951
971	987219	987264	987309	987353	987398
972	987666	987711	987756	987800	987845
973	988113	988157	988202	988247	988291
974	988559	988604	988748	988693	988737
975	989005	989049	989094	989138	989183
976	989449	989494	989539	989584	989628
977	989895	989939	989983	990028	990072
978	990339	990383	990428	990472	990516
979	990783	990827	990871	990916	990960
980	991226	991270	991315	991359	991403
981	991669	991713	991758	991802	991846
982	992111	992156	992199	992244	992288
983	992554	992598	992642	992686	992730
984	992995	993039	993083	993127	993172
985	993436	993480	993524	993568	993613
986	993877	993921	993965	994009	994053
987	994317	994361	994405	994449	994493
988	994756	994801	994845	994889	994933
989	995196	995240	995284	995328	995372
990	995635	995679	995723	995764	995811
991	996074	996117	996161	996205	996249
992	996512	996555	996599	996643	996687
993	996949	996993	997037	997080	997124
994	997386	997430	997474	997517	997561
995	997823	997867	997910	997954	997998
996	998259	998303	998347	998390	998434
997	998695	998739	998783	998826	998869
998	999133	999174	999218	999261	999305
999	999565	999609	999652	999696	999739

5	6	7	8	9	D
986996	987040	987085	987129	987175	45
987443	987488	987532	987577	987622	45
987889	987934	987979	988024	988068	45
988336	988381	988425	983469	988514	45
988782	988826	988871	988916	988960	45
989227	989272	989316	989361	989405	45
989672	989717	989761	989806	989850	44
990117	990161	990206	980150	990294	44
990561	990605	990649	990694	990738	44
991004	991049	991093	991137	991182	44
991448	991492	991536	991580	991625	44
991890	991935	991979	992023	992067	44
992333	992377	992421	992465	992509	44
992774	992819	992863	992907	992951	44
993216	993259	993304	993348	993392	44
993657	993701	993745	993789	993833	44
994097	994141	994185	994229	994273	44
994537	994581	994625	994669	994713	44
994977	995021	995065	995108	995152	44
995416	995459	995504	995547	995591	44
995854	995898	995942	995986	996029	44
996293	996337	996380	996424	996468	44
996731	996774	996818	996862	996906	44
997168	997212	997255	997299	997343	44
997605	997648	997692	997736	997779	44
998041	998085	998129	998170	998216	44
998477	998521	998564	998608	998652	44
998913	998956	998999	999043	999087	44
999348	999392	999435	999479	999522	44
999783	999826	999869	999913	999957	43

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A TABLE OF Proportional Parts,

WHEREBY

The Intermediate *Logarithms* of all Numbers,

AND THE

Numbers of all *Logarithms* From 10000 to 100000 may more readily be found out by the foregoing

Table of LOGARITHMS.

LONDON:

Printed by *M. Clark*, *Anno Dom.* MDCLXXXIV.

A TABLE OF Proportional Parts.

D	1	2	3	4	5	6	7	8	9
43	4	8	12	17	21	25	30	34	38
44	4	8	13	17	22	26	30	35	39
45	4	9	13	18	22	27	31	36	40
46	4	9	13	18	23	27	32	36	41
47	4	9	14	18	23	28	32	37	42
48	4	9	14	19	24	28	33	38	43
49	4	9	14	19	24	29	34	39	44
50	5	10	15	20	25	30	35	40	45
51	5	10	15	20	25	30	35	40	45
52	5	10	15	20	26	31	36	41	46
53	5	10	15	21	26	31	37	42	47
54	5	10	16	21	27	32	37	43	48
5	5	11	16	22	27	33	38	44	49
56	5	11	16	22	28	33	39	44	50
57	5	11	17	22	28	34	39	45	51
58	5	11	17	23	29	34	40	46	52
59	5	11	17	23	29	35	41	47	53
60	6	12	18	24	30	36	42	48	54
61	6	12	18	24	30	35	42	48	54
62	6	12	18	24	31	37	43	49	55

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
63	6	12	18	25	31	37	44	50	56
64	6	12	19	25	32	38	44	51	57
65	6	13	19	26	32	39	45	52	58
66	6	13	19	26	33	39	46	52	59
67	6	13	20	26	33	40	46	53	60
68	6	13	20	27	34	40	47	54	61
69	6	13	20	27	34	41	48	55	62
70	7	14	21	28	35	42	49	56	63
71	7	14	21	28	35	42	49	56	63
72	7	14	21	28	36	43	50	57	64
73	7	14	21	29	36	43	51	58	65
74	7	14	22	29	37	44	51	59	66
75	7	15	22	30	37	45	52	60	67
76	7	15	22	30	38	45	53	60	68
77	7	15	23	30	38	46	53	61	69
78	7	15	23	31	39	46	54	62	70
79	7	15	23	31	39	47	55	63	71
80	8	16	24	32	40	48	56	64	72
81	8	16	24	32	40	48	56	64	72
82	8	16	24	32	41	49	57	65	73
83	8	16	24	33	41	49	58	66	74
84	8	16	25	33	42	50	58	67	75
85	8	17	25	34	42	51	59	68	76
86	8	17	25	34	43	51	60	68	77
87	8	17	26	34	43	52	60	69	78
88	8	17	26	35	44	52	61	70	79
89	8	17	26	35	44	53	62	71	80
90	9	18	27	36	45	54	63	72	81
91	9	18	27	36	45	54	63	72	81
92	9	18	27	36	46	55	64	73	82

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
93	9	18	27	37	46	55	65	74	83
94	9	18	28	37	47	56	65	75	84
95	9	19	28	38	47	57	66	76	85
96	9	19	28	38	48	57	67	76	86
97	9	19	29	38	48	58	67	77	87
98	9	19	29	39	49	58	68	78	88
99	9	19	29	39	49	59	69	79	89
100	10	20	30	40	50	60	70	80	90
101	10	20	30	40	50	60	70	80	90
102	10	20	30	40	51	61	71	81	91
103	10	20	30	41	51	61	72	82	92
104	10	20	31	41	52	62	72	83	93
105	10	21	31	42	52	63	73	84	94
106	10	21	31	42	53	63	74	84	95
107	10	21	32	42	53	64	74	85	96
108	10	21	32	43	54	64	75	86	97
109	10	21	32	43	54	65	76	87	98
110	11	22	33	44	55	66	77	88	99
111	11	22	33	44	55	66	77	88	99
112	11	22	33	44	56	67	78	89	100
113	11	22	33	45	57	67	78	90	101
114	11	22	34	45	57	68	79	91	102
115	11	23	34	46	57	69	80	92	103
116	11	23	34	46	58	69	81	92	104
117	11	23	35	46	58	70	81	93	105
118	11	23	35	47	59	70	82	94	106
119	11	23	35	47	59	71	83	95	107
120	12	24	36	48	60	72	84	96	108
121	12	24	36	48	60	72	84	96	108
122	12	24	36	48	61	73	85	97	109

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
123	12	24	36	48	61	73	86	98	110
124	12	24	37	49	62	74	86	99	111
125	12	25	37	50	62	75	87	100	112
126	12	25	37	50	63	75	88	100	113
127	12	25	38	50	63	76	88	101	114
128	12	25	38	51	64	76	89	102	115
129	12	25	38	51	64	77	90	103	116
130	13	26	39	52	65	78	91	104	117
131	13	26	39	52	65	78	91	104	117
132	13	26	39	52	66	79	92	105	118
133	13	26	39	53	66	79	93	106	119
134	13	26	40	53	67	80	93	107	120
135	13	27	40	54	67	81	94	108	121
136	13	27	40	54	68	81	95	108	122
137	13	27	41	54	68	82	95	109	123
138	13	27	41	55	69	82	96	110	124
139	13	27	41	55	69	83	97	111	125
140	14	28	42	56	70	84	98	112	126
141	14	28	42	56	70	84	99	112	126
142	14	28	42	56	71	85	99	113	127
143	14	28	42	57	71	85	100	114	128
144	14	28	43	57	72	86	100	115	129
145	14	28	43	58	72	87	101	116	130
146	14	29	43	58	73	87	102	116	131
147	14	29	44	58	73	88	102	117	132
148	14	29	44	59	74	88	103	118	133
149	14	29	44	59	74	89	104	119	134
150	15	30	45	60	75	90	105	120	135
151	15	30	45	0	75	90	105	120	135
152	15	30	45	60	76	9	106	121	136

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
153	15	30	45	60	76	91	107	122	137
154	15	30	46	61	77	92	107	123	138
155	15	31	46	62	77	93	108	124	139
156	15	31	46	62	78	93	109	124	140
157	15	31	47	62	78	94	109	125	141
158	15	31	47	63	79	94	110	126	142
159	15	31	47	63	79	95	111	127	143
160	16	32	48	64	80	96	112	128	144
161	16	32	48	64	80	96	112	128	144
162	16	32	48	64	81	97	113	129	145
163	16	32	48	65	82	98	114	130	146
164	16	32	49	66	82	98	114	131	147
165	16	33	49	66	82	99	115	132	148
166	16	33	49	66	83	99	116	132	149
167	16	33	50	66	83	100	116	133	150
168	16	33	50	67	84	100	117	134	151
169	16	33	50	67	84	101	118	135	152
170	17	34	51	68	85	102	119	136	153
171	17	34	51	68	85	102	119	136	153
172	17	34	51	68	86	103	120	137	154
173	17	34	51	69	86	103	121	138	155
174	17	34	52	69	87	104	121	139	156
175	17	34	52	70	87	105	122	140	157
176	17	35	52	70	88	105	123	140	158
177	17	35	53	70	88	106	123	141	159
178	17	35	53	71	89	106	124	142	160
179	17	35	53	71	89	107	125	143	161
180	18	36	54	72	90	108	126	144	162
181	18	36	54	72	90	108	126	144	162
182	18	36	54	72	91	109	127	145	163

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
183	18	36	54	73	91	109	128	146	164
184	18	36	55	73	92	110	128	147	165
185	18	37	55	74	92	111	129	148	166
186	18	37	55	74	93	111	130	148	167
187	18	37	56	74	93	112	130	149	168
188	18	37	56	75	94	112	131	150	169
189	18	37	56	75	94	113	132	151	170
190	19	38	57	76	95	114	133	152	171
191	19	38	57	76	95	114	133	152	171
192	19	38	57	76	96	115	134	153	172
193	19	38	57	77	96	115	135	154	173
194	19	38	58	77	97	116	135	155	174
195	19	39	58	78	97	117	136	156	175
196	19	39	59	78	98	117	136	156	176
197	19	39	59	78	98	118	137	157	177
198	19	39	59	79	99	118	138	158	178
199	19	39	59	79	99	119	139	159	179
200	20	40	60	80	100	120	140	160	180
201	20	40	60	80	100	120	140	160	180
202	20	40	60	80	101	121	141	161	181
203	20	40	60	81	101	121	142	162	182
204	20	40	61	81	102	122	142	163	183
205	20	41	61	82	102	123	143	164	184
206	20	41	61	82	103	123	144	164	185
207	20	41	62	82	103	124	144	165	186
208	20	41	62	83	104	124	145	166	187
209	20	41	62	83	104	125	146	167	188
210	21	42	63	84	105	126	147	168	189
211	21	42	63	84	105	126	147	168	189
212	21	42	63	84	106	127	148	169	190

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
213	21	42	63	85	106	127	149	170	191
214	21	42	64	85	107	128	149	171	192
215	21	43	64	86	107	129	150	172	193
216	21	43	64	86	108	129	151	172	194
217	21	43	65	86	108	130	151	173	195
218	21	43	65	87	109	130	152	174	196
219	21	43	65	87	109	131	153	175	197
220	22	44	66	88	110	132	154	176	198
221	22	44	66	88	110	132	154	176	198
222	22	44	66	88	111	133	155	177	199
223	22	44	66	89	111	133	156	178	200
224	22	44	67	89	112	134	156	179	201
225	22	45	67	90	112	135	157	180	202
226	22	45	67	90	113	135	158	18	203
227	22	45	68	90	113	136	158	181	204
228	22	45	68	91	114	136	159	182	205
229	22	45	68	91	114	137	160	183	206
230	23	46	69	92	115	138	161	184	207
231	23	46	69	92	115	138	161	184	207
232	23	46	69	92	116	139	162	185	208
233	23	46	69	93	116	139	163	186	209
234	23	46	70	93	117	140	163	187	210
235	23	47	70	94	117	141	164	188	211
236	23	47	70	94	118	141	165	188	212
237	23	47	71	94	118	142	165	189	213
238	23	47	71	95	119	142	166	190	214
239	23	47	71	95	119	143	167	191	215
240	24	48	72	96	120	144	168	192	216
241	24	48	72	96	120	144	168	192	216
242	24	48	72	96	121	145	169	193	217

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
243	24	48	72	97	121	145	170	194	218
244	24	48	73	97	122	146	170	195	219
245	24	49	73	98	122	147	171	196	220
246	24	49	73	98	123	147	172	196	221
247	24	49	74	98	123	148	172	197	222
248	24	49	74	99	124	148	173	198	223
249	24	49	74	99	124	149	174	199	224
250	25	50	75	100	125	150	175	200	225
251	25	50	75	100	125	150	175	200	225
252	25	50	75	100	126	151	176	201	226
253	25	50	75	101	126	151	177	202	227
254	25	50	76	101	127	152	177	203	228
255	25	50	76	102	127	153	178	204	229
256	25	51	76	102	128	153	179	204	230
257	25	51	77	102	128	154	179	205	231
258	25	51	77	103	129	154	180	206	232
259	25	51	77	103	129	155	181	207	233
260	26	52	78	104	130	156	182	208	234
261	26	52	78	104	130	156	182	208	234
262	26	52	78	104	131	156	183	209	235
263	26	52	78	105	131	157	184	210	236
264	26	52	79	105	132	158	184	211	237
265	26	53	79	106	132	159	185	212	238
266	26	53	79	106	133	159	186	212	239
267	26	53	80	106	133	160	186	213	240
268	26	53	80	107	134	160	187	214	241
269	26	53	80	107	134	161	188	215	242
270	27	54	81	108	135	162	189	216	243
271	27	54	81	108	135	162	189	216	243
272	27	54	81	108	136	163	190	217	244

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
273	27	54	81	109	136	163	191	218	245
274	27	54	82	109	137	164	191	219	246
275	27	55	82	110	137	165	192	220	247
276	27	55	82	110	138	165	193	220	248
277	27	55	83	110	138	166	193	221	249
278	27	55	83	111	139	166	194	222	250
279	27	55	83	111	139	167	195	223	251
280	18	56	84	112	140	168	196	224	252
281	28	56	84	112	140	168	196	224	352
282	28	56	84	112	141	169	197	225	253
283	28	56	84	113	141	169	198	226	254
284	28	56	85	113	142	170	198	227	255
285	28	57	85	114	142	171	199	228	256
286	28	57	85	114	143	171	200	228	257
287	28	57	86	114	143	172	200	229	258
288	28	57	86	115	144	172	201	230	259
289	28	57	86	115	144	173	202	231	260
290	29	58	87	116	145	174	203	232	261
291	29	58	87	116	145	174	203	232	261
292	29	58	87	116	146	175	204	233	262
293	29	58	87	117	146	175	205	234	263
294	29	58	88	117	147	176	205	235	264
295	29	59	88	118	147	177	206	236	265
296	29	59	88	118	148	177	207	236	266
297	29	59	88	118	148	178	207	237	267
298	29	59	89	119	149	178	208	238	268
299	29	59	89	119	149	179	209	239	269
300	30	60	90	120	150	180	210	240	270
301	30	60	90	120	150	180	210	240	270
302	30	60	90	120	151	181	211	241	271

The Table of Proportional Parts

D	1	2	3	4	5	6	7	8	9
303	30	60	90	121	151	181	212	242	272
304	30	60	91	121	152	182	212	243	273
305	30	61	91	122	152	183	213	244	274
306	30	61	91	122	153	183	214	244	275
307	30	61	92	122	153	184	214	245	276
308	30	61	92	123	154	184	215	246	277
309	30	61	92	123	154	185	216	247	278
310	31	62	93	124	155	186	217	248	279
311	31	62	93	124	155	186	217	248	279
312	31	62	93	124	156	187	218	249	280
313	31	62	93	125	156	187	219	250	281
314	31	62	94	125	157	188	219	251	282
315	31	63	94	126	157	189	220	252	283
316	31	63	94	126	158	189	221	252	284
317	31	63	95	126	158	190	221	253	285
318	31	63	95	127	159	190	222	254	286
319	31	63	95	127	159	191	223	255	287
320	32	64	96	128	160	192	224	256	288
321	32	64	96	128	160	192	224	256	288
322	32	64	96	128	161	193	225	257	289
323	32	64	96	129	161	193	226	258	290
324	32	64	97	129	162	194	226	259	291
325	32	65	97	130	162	195	227	260	292
326	32	65	97	130	163	195	228	260	293
327	32	65	98	130	163	196	228	261	294
328	32	65	98	131	163	196	229	262	295
329	32	65	98	131	164	197	230	263	296
330	33	66	99	132	165	198	231	264	297
331	33	66	99	132	165	198	231	264	297
332	33	66	99	132	166	199	232	265	298

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
333	33	66	99	133	166	199	233	266	299
334	33	66	100	133	167	200	233	267	300
335	33	67	100	134	167	201	234	268	301
336	33	67	100	134	168	201	235	268	302
337	33	67	101	134	168	202	235	269	303
338	33	67	101	135	169	202	236	270	304
339	33	67	101	135	169	203	237	271	305
340	34	68	102	136	170	204	238	272	306
341	34	68	102	136	170	204	238	272	306
342	34	68	102	136	171	205	239	273	307
343	34	68	102	137	171	205	240	274	308
344	34	68	103	137	172	206	240	275	309
345	34	69	103	138	172	207	241	276	310
346	34	69	103	138	173	207	242	276	311
347	34	69	104	138	173	208	242	277	312
348	34	69	104	139	174	208	243	278	313
349	34	69	104	139	174	209	244	279	314
350	35	70	105	140	175	210	245	280	315
351	35	70	105	140	175	210	245	280	315
352	35	70	105	140	176	211	246	281	316
353	35	70	105	141	176	211	247	282	317
354	35	70	106	141	177	212	247	283	318
355	35	71	106	142	177	213	248	284	319
356	35	71	106	142	178	213	249	284	320
357	35	71	107	142	178	214	249	285	321
358	35	71	107	143	179	214	250	286	322
359	35	71	107	143	179	215	251	287	323
360	36	72	108	144	180	216	252	288	324
361	36	72	108	144	180	216	252	288	324
362	36	72	108	144	181	217	253	289	325

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
363	36	72	108	145	181	217	254	290	326
364	36	72	109	145	182	218	254	291	327
365	36	73	109	146	182	219	255	292	328
366	36	73	109	146	182	219	256	292	329
367	36	73	110	146	183	220	256	293	330
368	36	73	110	147	184	220	257	294	331
369	36	73	110	147	184	221	258	295	332
370	37	74	111	148	185	222	259	296	333
371	37	74	111	148	185	222	259	296	333
372	37	74	111	148	186	223	260	297	334
373	37	74	111	149	186	223	261	298	335
374	37	74	112	149	187	224	261	299	336
375	37	75	112	150	187	225	262	300	337
376	37	75	112	150	188	225	263	300	338
377	37	75	113	150	188	226	263	301	339
378	37	75	113	151	189	226	264	302	340
379	37	75	113	151	189	227	265	303	341
380	38	76	114	152	190	228	266	304	342
381	38	76	114	152	190	228	266	304	342
382	38	76	114	152	191	229	267	305	343
383	38	76	114	153	191	229	268	306	344
384	38	76	115	153	192	230	268	307	345
385	38	77	115	154	192	231	269	308	346
386	38	77	115	154	193	231	270	308	347
387	38	77	116	154	193	232	270	309	348
388	38	77	116	155	194	232	271	310	349
389	38	77	116	155	194	233	272	311	350
390	39	78	117	156	195	233	273	312	351
391	39	78	117	156	195	233	273	312	351
392	39	78	117	156	196	234	274	313	352

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
393	39	78	117	157	196	235	275	314	353
394	39	78	118	157	197	236	275	315	354
395	39	79	118	158	197	237	276	316	355
396	39	79	118	158	198	237	277	316	356
397	39	79	119	158	198	238	277	317	357
398	39	79	119	159	199	238	278	318	358
399	39	79	119	159	199	239	279	319	359
400	40	80	120	160	200	240	280	320	360
401	40	80	120	160	200	240	280	320	360
402	40	80	120	160	201	241	281	321	361
403	40	80	120	161	201	241	282	322	362
404	40	80	121	161	202	242	232	323	363
405	40	81	121	162	202	243	283	324	364
406	40	81	121	162	203	243	284	324	365
407	40	81	122	162	203	244	284	325	366
408	40	81	122	163	204	244	285	326	367
409	40	81	122	163	204	245	286	327	368
410	41	82	123	164	205	246	287	328	369
411	41	82	123	164	205	246	287	328	369
412	41	82	123	164	206	247	288	329	370
413	41	82	123	165	206	247	289	330	371
414	4	82	124	165	207	248	289	331	372
415	41	83	124	166	207	249	290	332	373
416	41	83	124	166	208	249	291	332	374
417	41	83	125	166	208	250	291	333	375
418	41	83	125	167	209	250	292	334	376
419	41	83	125	167	209	251	293	335	377
420	42	84	126	168	210	252	294	336	378
421	42	84	126	168	210	252	294	336	378
422	42	84	126	168	211	253	295	337	379

The Table of Proportional Parts.

D	1	2	3	4	5	6	7	8	9
423	42	84	126	169	211	253	296	338	380
424	42	84	127	169	212	254	296	33[illegible]	381
425	42	85	127	170	212	255	297	340	3[illegible]2
426	42	85	127	170	213	255	29[illegible]	340	383
427	42	85	128	170	213	256	298	341	384
428	42	85	128	171	214	256	299	342	385
429	42	85	128	171	214	257	300	343	386
430	43	86	129	172	215	258	301	344	387
431	43	86	129	172	215	258	301	344	387
432	43	86	129	172	216	259	302	345	388
433	43	86	129	173	216	259	303	346	389
434	43	86	130	173	217	260	304	347	390
435	43	87	130	174	217	261	304	348	391

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